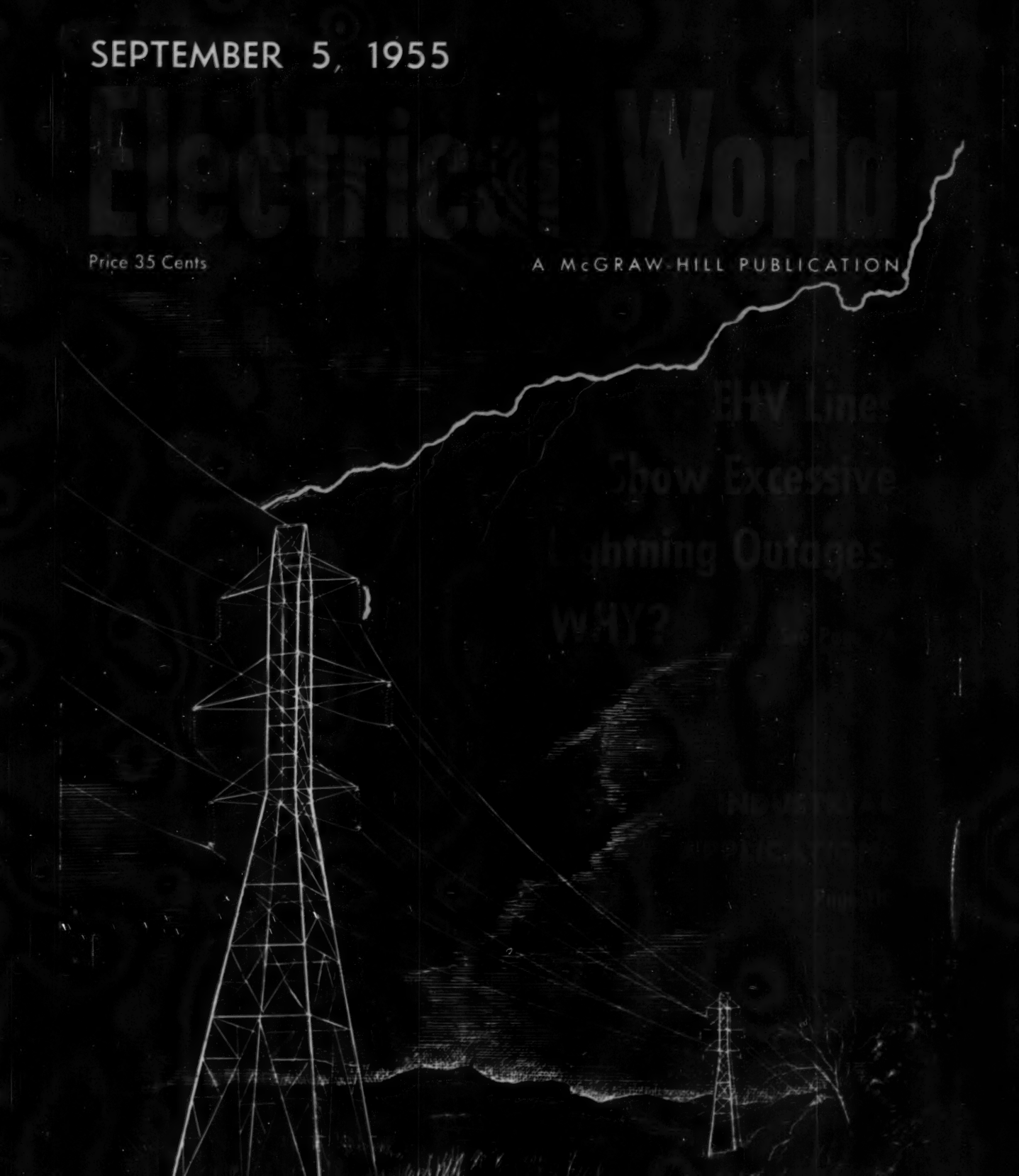
SEPTEMBER 5, 1955

Electrical World

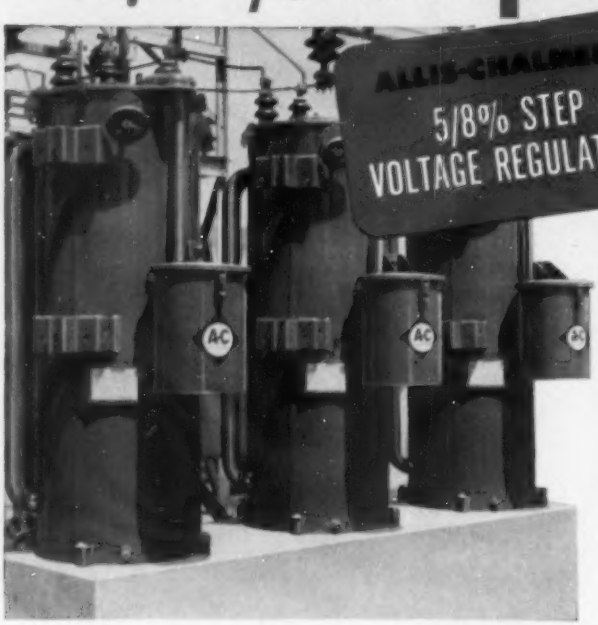
Price 35 Cents

A McGRAW-HILL PUBLICATION

EHV Lines Show Excessive Lightning Outages. WHY?



HOW to add revenue with 5/8% Step Regulators

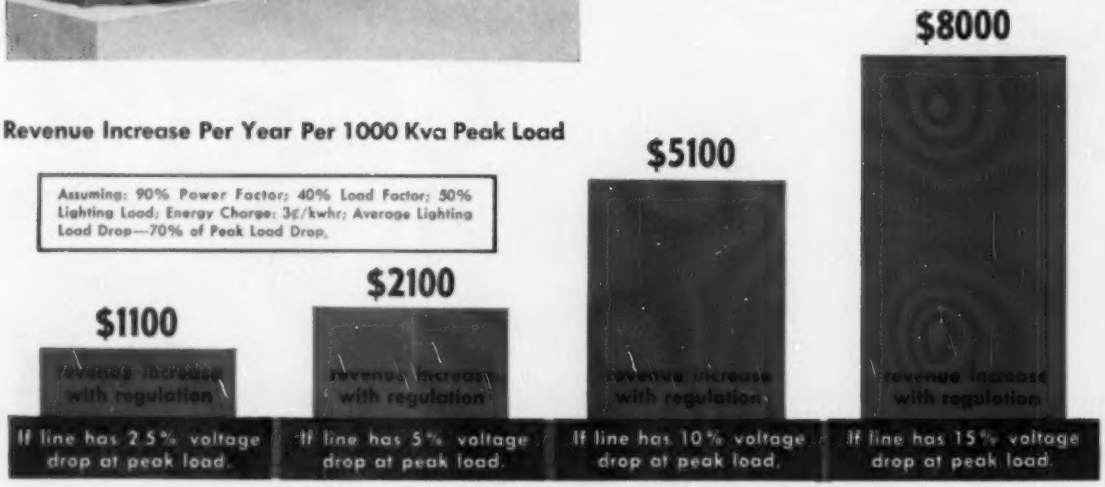


With only 5% low voltage at peak loads, you can increase revenue $2100 per regulator the first year by correcting voltage with an Allis-Chalmers distribution regulator. That increase is more than the regulator costs. Taking all factors into consideration, it's enough to pay back initial investment in less than two years, in most cases.

And you improve your maintenance picture too. With A-C regulators reducing or eliminating complaints due to low voltage, you get more from service crews and equipment. Use them where they are really needed instead of wasting manpower and money testing voltage at customers' homes.

Revenue Increase Per Year Per 1000 Kva Peak Load

Assuming: 90% Power Factor; 40% Load Factor; 50% Lighting Load; Energy Charge: 3¢/kwhr; Average Lighting Load Drop—70% of Peak Load Drop.


$1100
revenue increase with regulation
If line has 2.5% voltage drop at peak load.
$2100
revenue increase with regulation
If line has 5% voltage drop at peak load.
$5100
revenue increase with regulation
If line has 10% voltage drop at peak load.
$8000
revenue increase with regulation
If line has 15% voltage drop at peak load.

Low Maintenance, Long Life Proved by Experience

When you specify an Allis-Chalmers voltage regulator you know you'll get a unit with minimum maintenance, longest possible life. No other ⅝% step regulator gives you proof from years of actual field experience. Allis-Chalmers step-type regulators — all using the same basic designs — have been turning in excellent service records for over 20 years.

More facts are available. Get them from your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4565

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Electrical World

Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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and for the same reason: MOLD CURING

Truck tires are tough. Every one of them is vulcanized in a metal mold—mold-cured—to guarantee the brute strength and toughness it must have to lick the rutted pavements, gravel roads, rubber-eating skids and tremendous loads that are part of its day's work. Thorough, uniform curing makes the tire a uniformly rugged "shoe" incorporating the strength of all the individual components.

Hazacord cables are tough, too. Every foot of every tiny flexible cord or heavy high-voltage cable is mold-cured to give service-proved "truck-tire" toughness and durability. Even, thorough curing guarantees a strong, compact cable assembly that adds to the remarkable strength of its components yet retains maximum workability and flexibility. This long-lived construction has made Hazacord the solution to difficult installations where other portable cables have failed after relatively short operating periods.

For any type of portable power distribution in industry, mines or utilities there is a tough Hazacord construction that is best for the job. Ask your jobber or your nearest Hazard representative for details or write for Bulletin H-451, Hazard Insulated Wire Works, Division of The Okonite Company, Passaic, N. J.

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!

Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

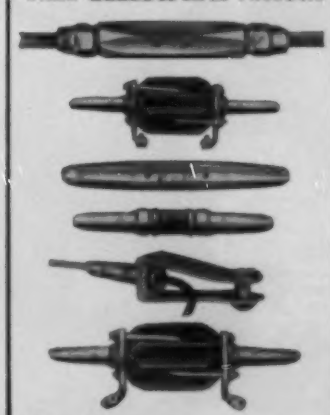
Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.

OTHER *Electroline* PRODUCTS



Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO

FLORIDA POWER & LIGHT SELECTS S&C POWER

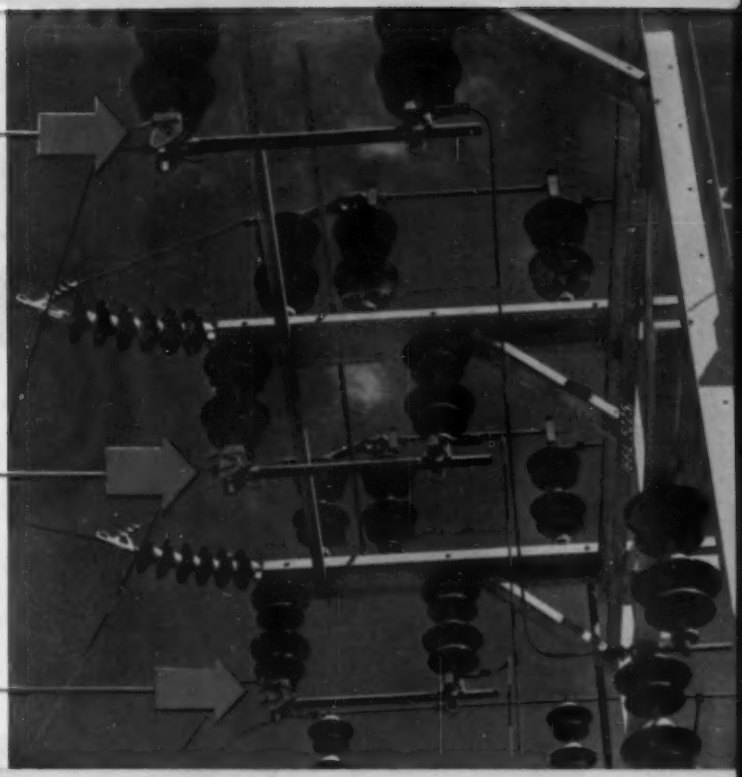
Florida Power & Light Company is the Sunshine State's fastest growing utility. Year after year more manufacturers, more businesses, and more commercial enterprises are moving into the territory it serves. Rapid population gains have increased customers by 138%, and more than tripled demands on the Florida Power & Light system since the end of World War II.

To satisfy these demands, Florida Power & Light has carried on an extensive power expansion program which, by the end of 1955, will have required the investment of $250,000,000 since V-J Day.

For an expansion program of such importance, it is only natural that the greatest possible care is used to make sure that service continuity is maintained and system equipment is protected.

Aerial view of the Hialeah section of Miami—one of the areas where rapid building of homes and industry has increased demand for light and power to six times what it was ten years ago. Hialeah Park is nationally famous . . . open the year around . . . host to hundreds of thousands annually.

COMPANY FUSES



For example, S&C Drop-Out Power Fuses—Type SMD (marked by arrows, right) are installed at Hialeah substation to protect two 7500 kva 69/13 kv transformers which serve Hialeah Park as well as the hundreds of homes and many small industrial plants which surround it.

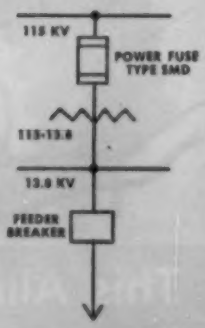
How S&C Power Fuses Are Used in the 69 Kv and 115 Kv System Protection Schemes

The transmission lines of Florida Power & Light Company are tapped at intervals to feed distribution substations. As was originally planned, the power transformers were not always provided with primary protection against secondary faults since primary breakers could not be economically justified.

After a 115 kv power transformer had been lost (for lack of such protection) the matter of protection was reconsidered. It was then decided that this protection was essential and that the device selected must meet these special requirements.

1. Provide system protection over a wide range of fault currents.
2. Coordinate with the transformer damage curve to provide maximum protection to the transformers.
3. Give complete coordination with secondary protective devices over the full range of fault currents.
4. Be capable of withstanding the recovery voltages which might be encountered under various fault conditions.
5. Be low in cost.

S&C Power Fuses, Type SMD, were found to meet all these requirements. Further details of Florida Power & Light's application of these fuses may be found in AIEE Paper No. DP 55-405.



Typical substation tapped directly from Florida Power & Light's transmission lines.

Specialists in High-Voltage Circuit Interruption since 1910

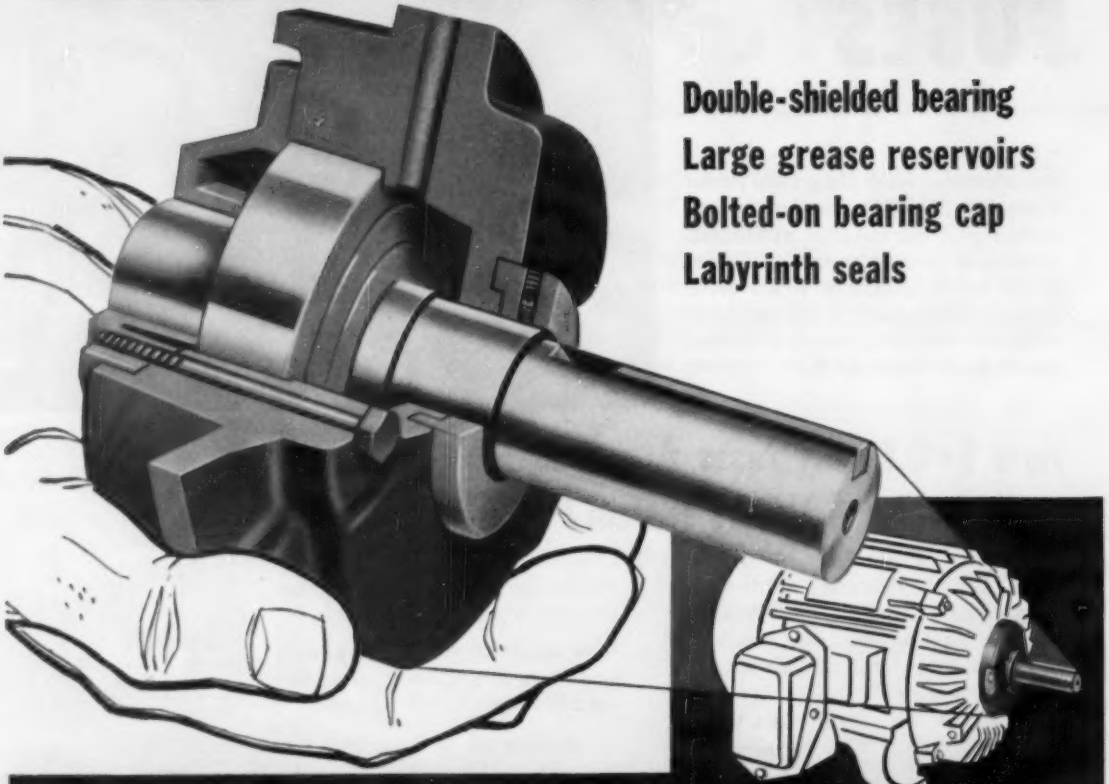
S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

Here Is Extra Motor Value



Double-shielded bearing
Large grease reservoirs
Bolted-on bearing cap
Labyrinth seals

This Allis-Chalmers Bearing Design Gives More for Your Motor Dollar

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

You can lubricate these bearings without dismantling motor. Pipe-tapped holes in the bearing housings at two points provide means for inserting new grease, flushing out old grease and of relieving pressure during re-greasing.

Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7225.

A-4616

ALLIS-CHALMERS

HIGHER INTERRUPTING RATINGS! SAME LOW COST!

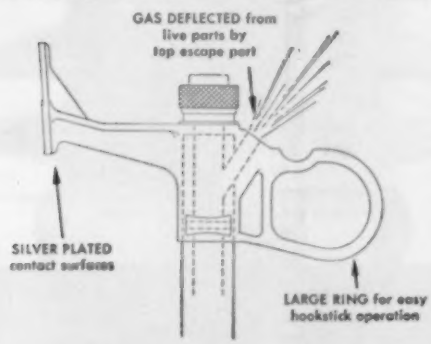
SOUTHERN STATES NEW TYPE CV-33-F CUTOUT

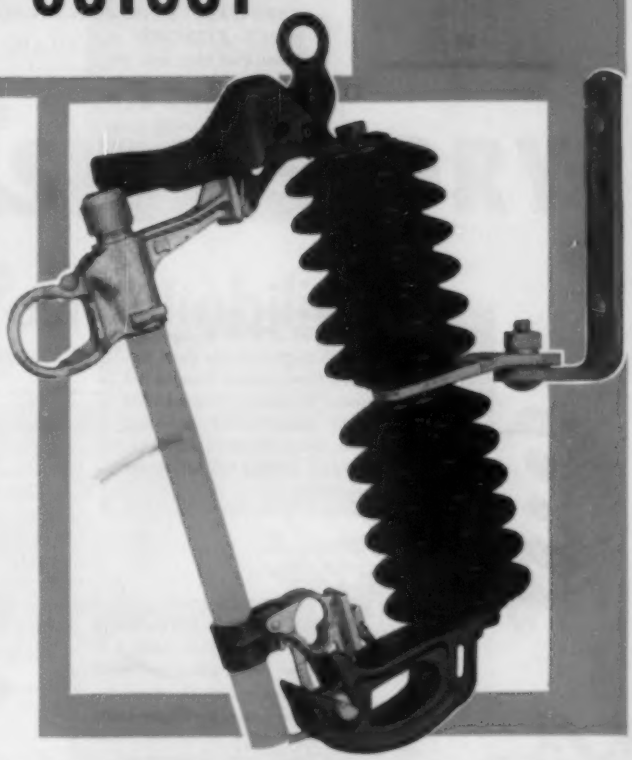
Here is Southern States' answer to stepped up protection for continually increasing system capacities—the new Type CV-33-F control-vented cutout . . . tougher, more versatile than any of its famous predecessors . . . at no increase in price!

Install the Type CV-33-F today with full assurance that it will take in stride the heavier faults sure to come in the years ahead. Build a new margin of safety into your system which will mean substantial savings over the years!

The Type CV-33-F functions dependably in all ranges of cutout operation . . . from restricted faults to those of high magnitude. It is a simple, sturdy unit. Nothing to go wrong or get misplaced. No spare parts necessary to put it back into operation—only a conventional universal button-head link.

Specify Southern States Type CV-33-F Cutouts and get extra protection without extra cost.


GAS DEFLECTED from live parts by top escape port
SILVER PLATED contact surfaces
LARGE RING for easy hookstick operation



Check These Interrupting Ratings Available at No Increase in Price

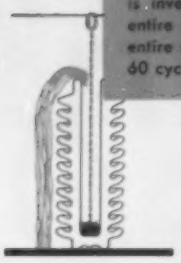
TYPE CV-33-F			TYPE CV-33-FH		
KV	CONT. CURRENT	RMS AMPS INT. CAPACITY	KV	CONT. CURRENT	RMS AMPS INT. CAPACITY
5	100	6,000	5	100	8,000
			5	200	8,000
7.5	100	6,000	7.5	100	8,000
			7.5	200	8,000
15	100	4,000	15	100	6,000
25	100	2,000	15	200	6,000

NOTE. ALL STATIONARY CONTACTS ARE RATED 200 AMPS

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

100% ELECTRICAL TESTING • Soundness of head (where such a ceramic piece is most likely to be cracked) is assured by flashover test of every piece. Before plugging or assembly, porcelain body is inverted, a chain dropped the entire depth of the hole, and the entire unit subjected to a 3-minute 60 cycle flashover.

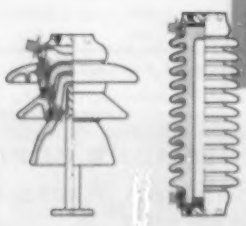


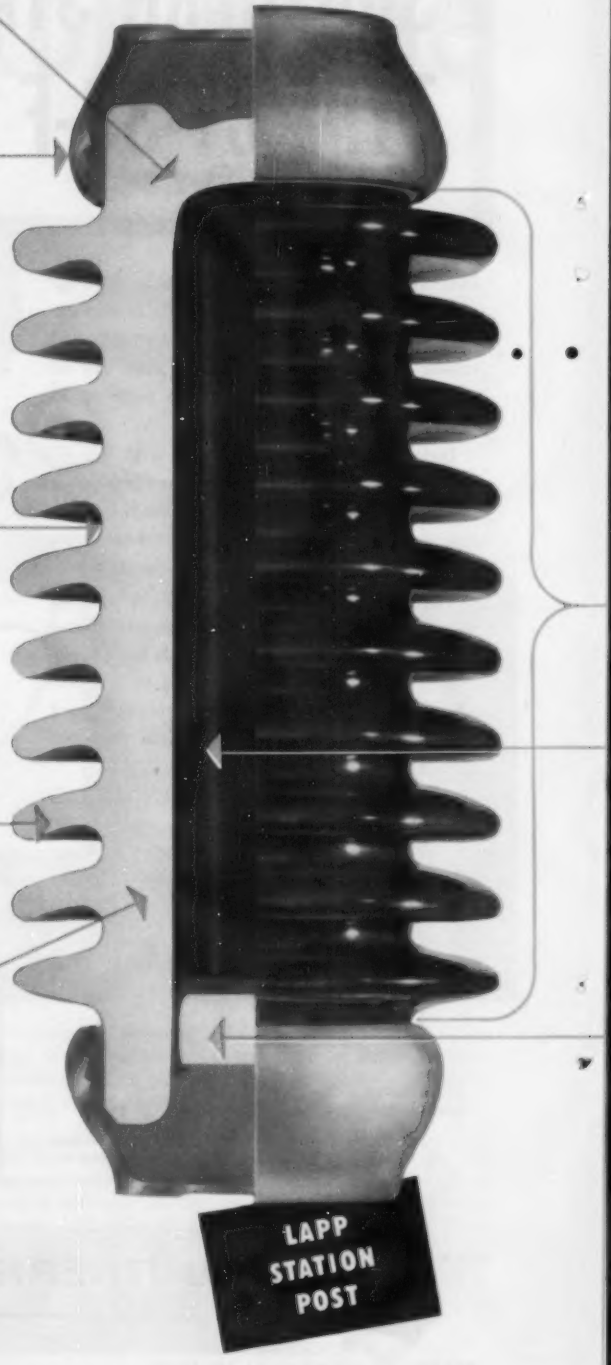
HARDWARE EXTERNALLY ATTACHED • Bases and caps are cemented ON. Porcelain is loaded only in large-area low-intensity compression grip; this eliminates the cause of insulator cracking.

UNIFORM LEAKAGE PATH • Leakage distance secured through multiple short petticoats—*Lapp fog-type design*. Flanges are spaced for natural cleaning action of wind and rain—avoid concentrated hot-spots where local stress can precipitate flashover. This is also the ideal surface for horizontal mounting of insulators.

SHORT STURDY PETTICOATS • Protect body from impact or flashover. Will withstand much more severe attack than required to crack shell-type units, yet will finally break off clean and leave body undamaged.

RIGID UNDER DEFLECTION • One piece porcelain body. No nested porcelain parts, no internal pins, studs or inserts—no internal forces to load porcelain in tension.





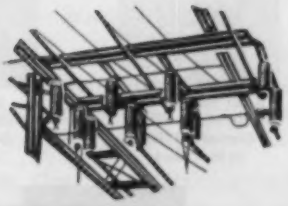
The service record on switch and bus insulators on any major system will show the superiority of Lapp Station Post insulators. Since 1931, these units have been handling dirt conditions, lightning flashover, mechanical shock and loading—with fewer outages, and at lower maintenance and replacement cost, than any other type of station insulator. One reason, of course, is the basic superiority of the design—the Lapp conception of giving mechanical as well as electrical responsibility to a column of porcelain. The other reason is that *Lapp knows how to make 'em*—how to take advantage of the special strengths of porcelain and avoid its weaknesses. The result is the Lapp Station Post; it will improve service and save money on *your* system. Lapp Insulator Co., Inc., Le Roy, New York.

. . . . THE INSIDE STORY

of Station Post reliability

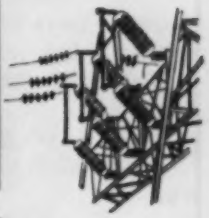
"STRAIGHT-LINE" FLASHOVER • Live terminals are separated by full length of insulator; flashover goes *outside* the unit. Loss of one or more petticoats does not reduce flashover distance.

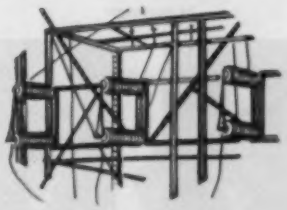
INSIDE GLAZED • All Lapp Post porcelains are glazed inside and outside—a Lapp extra-quality feature that makes for added cleanliness and more critical visual inspection.



PERMANENTLY PLUGGED PORCELAIN • *After thorough electrical testing,* porcelain body is plugged with porcelain and natural rubber—a Lapp design that has stood the service test of 20 years. This assures a permanently clean, dry hole; avoids internal conductive contamination.

SAME STRENGTH INVERTED • Mount 'em upright, obliquely, horizontally, or inverted—mechanical and electrical characteristics give a safe margin of operating security.





Lapp

GRAYBAR OFFICERS

W. E. HENGES
President
Started 1913, as Receiving Clerk

R. B. SAYRE
Vice President
Started 1921 as Warehouseman

D. WALLACE
Vice President
Started 1922 as Assistant Accountant

H. METZ
District Mgr., New York
Started in 1914
in Student Course

E. E. MARTIN
District Mgr., Boston
Started in 1920
in Student Course

J. A. MAYER
District Mgr., Philadelphia
Started in 1913
as Equipment Installer

L. G. FIELDS
District Mgr., Richmond
Started in 1924
as Selector

A. D. HAMMOND
District Mgr., Atlanta
Started in 1906
as Mail Clerk

D. L. HARPER
District Mgr., Jacksonville
Started in 1933
as Salesman

C. E. KIRKPATRICK
District Mgr., Cleveland
Started in 1936
in Office Sales

J. E. CARROLL
District Mgr., Pittsburgh
Started in 1935
as Salesman

H. G. COOK
District Mgr., Detroit
Started in 1920
as Messenger

E. R. YONKERS
District Mgr., Cincinnati
Started in 1933
as Salesman

W. E. GUY
District Mgr., Chicago
Started in 1924
as Salesman

N. W. ZILCH
District Mgr., Minneapolis
Started in 1934
as Serviceman

C. S. POWELL
District Mgr., St. Louis
Started in 1914
in Student Course

W. FRAZIER
District Mgr., Kansas City
Started in 1911
as Office Boy

V. A. ELMBLAD
District Mgr., Dallas
Started in 1920
as Warehouseman

J. E. FONTAINE
District Mgr., Houston
Started in 1928
as Warehouseman

R. W. KIMBERLIN
District Mgr., San Francisco
Started in 1922
as Sales Record Clerk

and DISTRICT MANAGERS

A. C. LAMPERTI
Comptroller
Started 1920 as Bookkeeper

F. E. GIBSON
Treasurer
Started 1920 as Service & Claims Clerk

787
years
(and 11 months)
of
electrical
experience

*Average service 33 years

S. W. SCOTT
District Mgr., Los Angeles
Started in 1928
as Salesman

J. P. LAWTON
District Mgr., Seattle
Started in 1923
as Warehouseman

all began "in the ranks"

Experienced men make an experienced organization – one that can be relied on to serve you well.

Graybar, oldest and largest independent distributor of "everything electrical", has long proved the soundness of this principle by continually filling key company posts from within.

The result? An experienced, close-knit management group who – as clerks, office boys, and salesmen – *themselves* helped build the foundation for Graybar's ever-growing list of customers.

It's easy, then, to see why – with the same opportunities for advancement – each and every Graybar employee has a powerful incentive to do his job well.

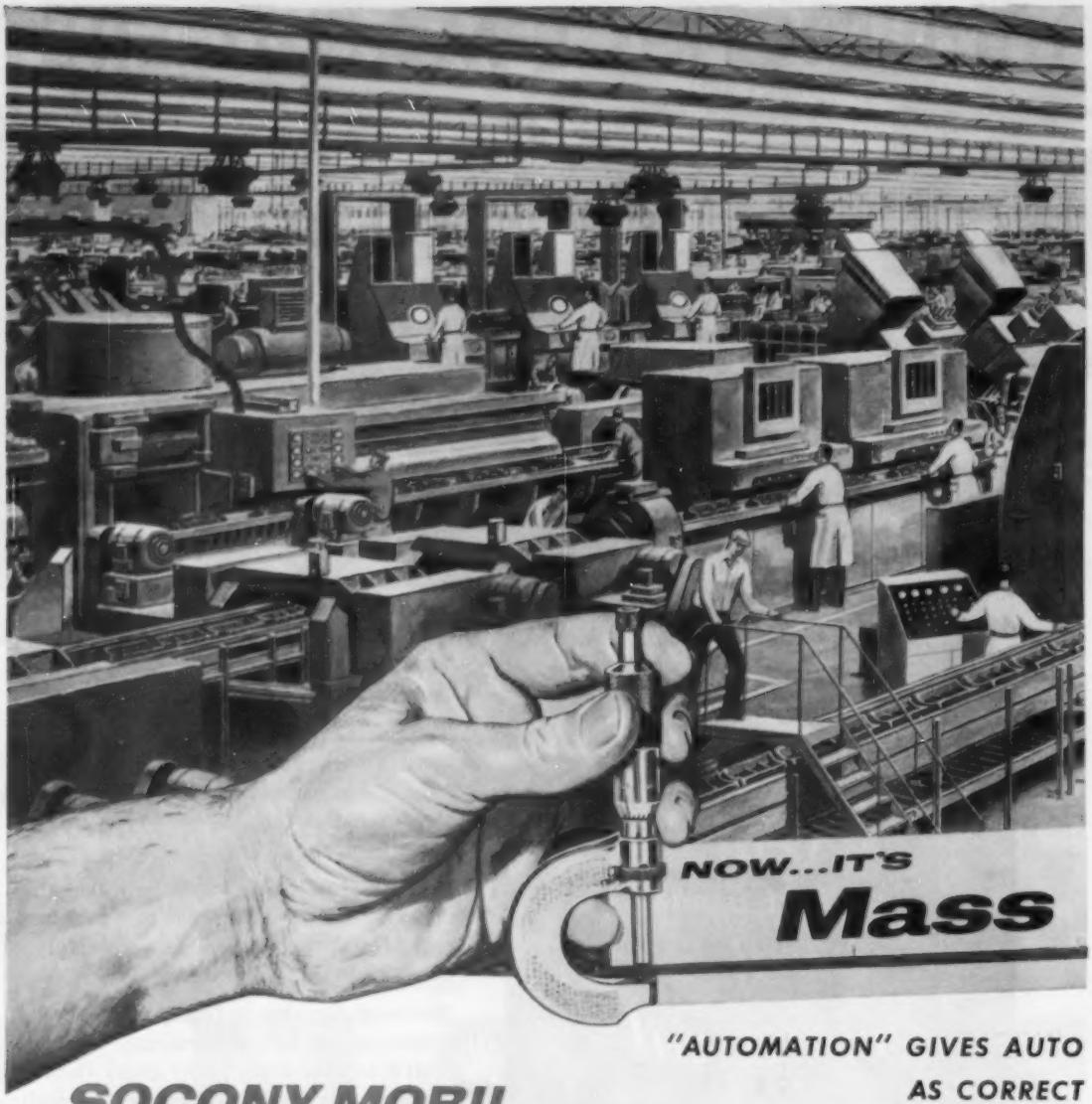
Moreover, Graybar is totally owned by its operating and retired personnel.
That's another reason why every Graybar employee is personally interested in meeting your electrical needs accurately, helpfully, and as rapidly as possible.
Graybar Electric Company, Inc.,
Executive Offices: Graybar Building,
New York 17, N. Y.

539-99

100,000 first-quality electrical items are distributed throughout the nation . . .

via GraybaR

IN OVER 120 PRINCIPAL CITIES



"AUTOMATION" GIVES AUTO AS CORRECT

It was the fabulous automobile industry that popularized mass production a generation ago. Now, through the miracle of "Automation," this same industry is combining mass production with *mass precision* to produce better cars—for more people—than ever before possible.

Today, in leading plants, rough metal forgings and castings enter one battery of machines, are routed by automatic transfer devices to succeeding batteries of machines, and finally emerge as finished engine blocks, crankshafts, pistons, etc.

In one plant, for example, rough engine blocks pass at the rate of 100 an hour through 637 different machines and transfers, and come out—after some 1,000 separate machining and testing operations—finished to within tolerances of one ten-thousandth of an inch.

SOCONY MOBIL

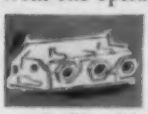
Correct Lubrication

FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates:
MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION
Formerly Socony-Vacuum Oil Company, Inc.

INDUSTRY DRAMATIC BOOST BOTH IN QUALITY AND QUANTITY, LUBRICATION PLAYS EVER MORE VITAL ROLE

What Automation Is . . . This linking together of machines and transfer devices to obtain high precision finish of mass-produced parts is called *"Automation."* The many devices used to achieve this marvel of mass precision stagger the imagination. Electronic, pneumatic and hydraulic equipment controls the transfer of parts from one operation to another, positions each part for



accurate machining, indicates when to change cutting tools, measures and sorts parts, pin-points trouble instantly should it develop. Even testing is done electronically, with parts automatically inspected at frequent intervals and ejected from the line if out of tolerance.

Correct Lubrication Vital . . . In all this maze of complex machinery there is one common factor of ever increasing importance. This is *Correct Lubrication.* For in Automation—more than in any other manufacturing process—continuous, trouble-free operation and immediate response of every moving machine part spell the difference between success and failure. Should a single

part of a single machine fail, it can bring an entire battery of machines to a standstill.

This is why so many leaders in Automation have entrusted their multi-million dollar plants to Socony Mobil—world leader in lubrication. In these plants, Socony Mobil engineers work continually with operators and machine builders through a program of Correct Lubrication to help keep production flowing smoothly—hold maintenance costs to a minimum.

Whatever *your* manufacturing process—whatever you make—you can get a similar program of Correct Lubrication started in your plant to help improve your production—cut your costs. Just call Socony Mobil.

R&IE

FACTS ABOUT Exide®
MANCHEX® BATTERIES

POSITIVE OPERATION
OF CIRCUIT BREAKERS IS ASSURED BY EXIDE-MANCHEX BATTERIES

HIGH-POWER TESTS AT THE SWITCHGEAR LABORATORY HELP GENERAL ELECTRIC ENGINEERS IN DESIGNING ALL SIZES OF CIRCUIT BREAKERS AND OTHER SWITCHING EQUIPMENT. THE BATTERY USED FOR TRIPPING AND CLOSING BREAKERS IN THIS DEVELOPMENT WORK ARE EXIDE-MANCHEX. THEY PROVIDE THE MOST DEPENDABLE AND DURABLE SOURCE OF POWER FOR UNFAILING OPERATION OF VITAL ELECTRICAL EQUIPMENT.

SINCE 1889, EXIDE ENGINEERS

HAVE EXPERIMENTED WITH THOUSANDS OF BATTERY IDEAS. THE RESULT IS THE HIGH QUALITY EXIDE-MANCHEX BATTERY NOW SO WIDELY USED BY ELECTRIC UTILITIES THROUGHOUT THE U.S.

BUTTONS OF LEAD PROVIDE DEPENDABLE POWER... LONGEST BATTERY LIFE

THE IMPROVED PLANTE TYPE POSITIVE PLATES OF THE EXIDE-MANCHEX BATTERY ARE OF MANCHESTER DESIGN-AN EXCLUSIVE EXIDE FEATURE. BUTTONS OF LEAD DELIVER THE POWER YOU NEED, WHEN YOU NEED IT. OVER A HALF CENTURY OF DEPENDABLE PERFORMANCE IN ELECTRIC UTILITY STATIONS HAS DEMONSTRATED THAT EXIDE BATTERIES WITH THEIR BUTTONS OF POWER ARE YOUR BEST BATTERY BUY-AT ANY PRICE!

LET EXIDE HELP SOLVE YOUR SWITCHGEAR BATTERY PROBLEMS. ❶ CALL AN EXIDE SALES ENGINEER FOR FULL DETAILS. ❷ WRITE FOR BULLETIN 210-WHICH TELLS HOW BATTERIES ARE MOST EFFICIENTLY USED IN SWITCHGEAR OPERATIONS.

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

R&IE

METAL ENCLOSED FUSED INTERRUPTER SWITCHES

Because you demand RELIABLE *Switchgear – for . . .*

ECONOMY—Where quality load interrupter service is required on important circuits—where economy of investment is important—specify R&IE Fused Interrupter Switches. Here's why—

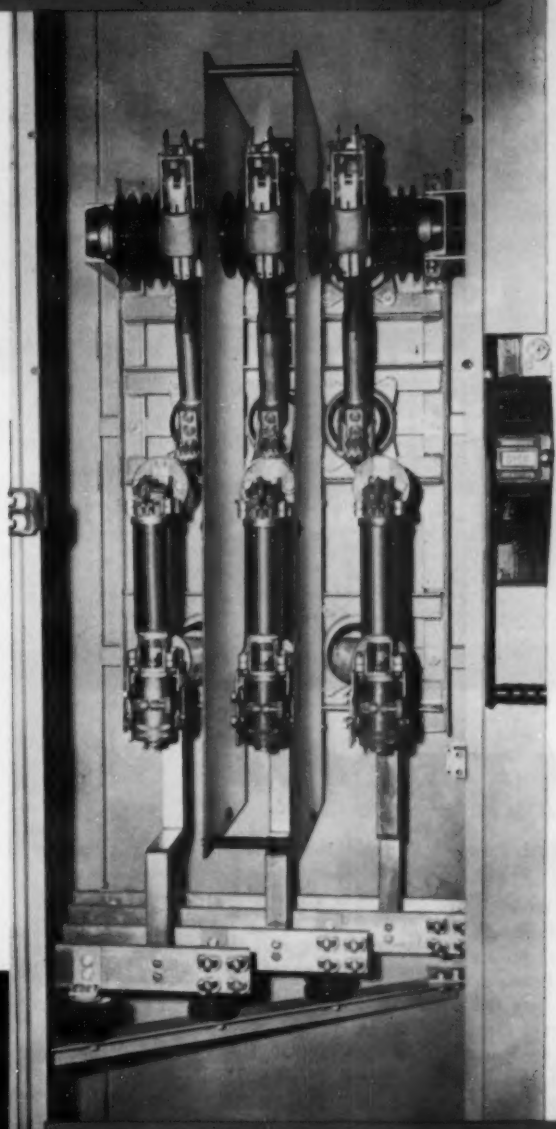
- All parts functionally designed with careful cost consideration.
- Flexibility of arrangement, standard or special, can save you money.

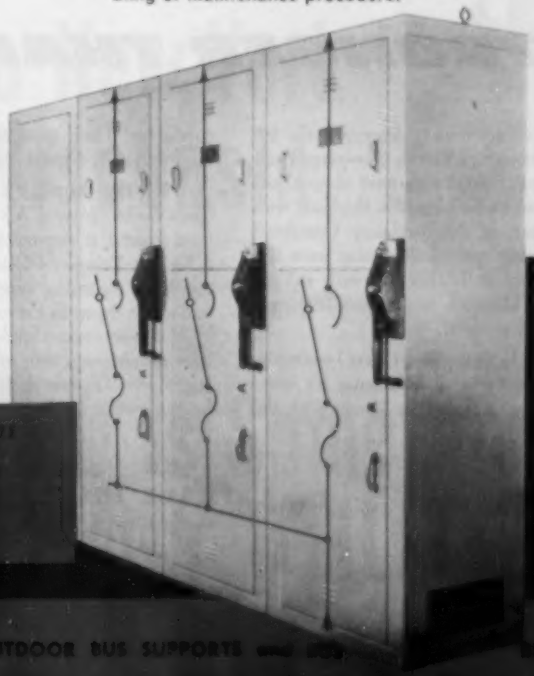
SPACE SAVING—Minimum space required for any combination.

- Overall dimensions less than most conventional switching devices. Double barriers between fuses.
- Less housing depth required for 3-position switching with compact rotary-type disconnect.

SAFETY OPERATION—Arc-extinguishing interrupter switches, enclosed in modern, well-designed cubicles provide maximum safety.

- Arcs extinguished safely and quickly inside interrupter tube—with proper interruption assured thru sequencing device on operating mechanism.
- Visible open-gap disconnecting switches.
- Kirk Key or electric interlocking for safe operating or maintenance procedure.





For Load Center Switching Solutions
write to

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

INDOOR BUS SUPPORTS and BUS FABRICATION • OUTDOOR BUS SUPPORTS and BUS [illegible] STATION

STRUCTURES—steel or aluminum • TESTING DEVICES • KIRK KEY INTERLOCK SYSTEMS • ISOLATED PHASE BUS STRUCTURES • INTERRUPTER SWITCHES

STRONGER THAN THE PIN

In laboratory tests to determine the torsion strength of Kimble *Tempered* Glass Insulators, wood pins were sheared off, and lead-bushed threads stripped, with no failure of the Insulators. Cantilever tests using special alloy pins were discontinued at 10,000 lbs. with still no failure. Ultimate impact tests averaged 130 inch pounds!

Kimble *Tempered* Glass Insulators save installation time because it's never necessary to loosen for lineup with the conductor. Their great strength always allows another quarter-turn.

If it's on the pin, it's in service

Tests far in excess of A.I.E.E. standards have proved it impossible to puncture a Kimble *Tempered* Glass Insulator in air. Even lightning surges have failed to damage them. In the event of shattering due to severe mechanical shock, insulator disintegrates into small, non-sharp fragments. Trouble shooters can locate broken insulator—fast.

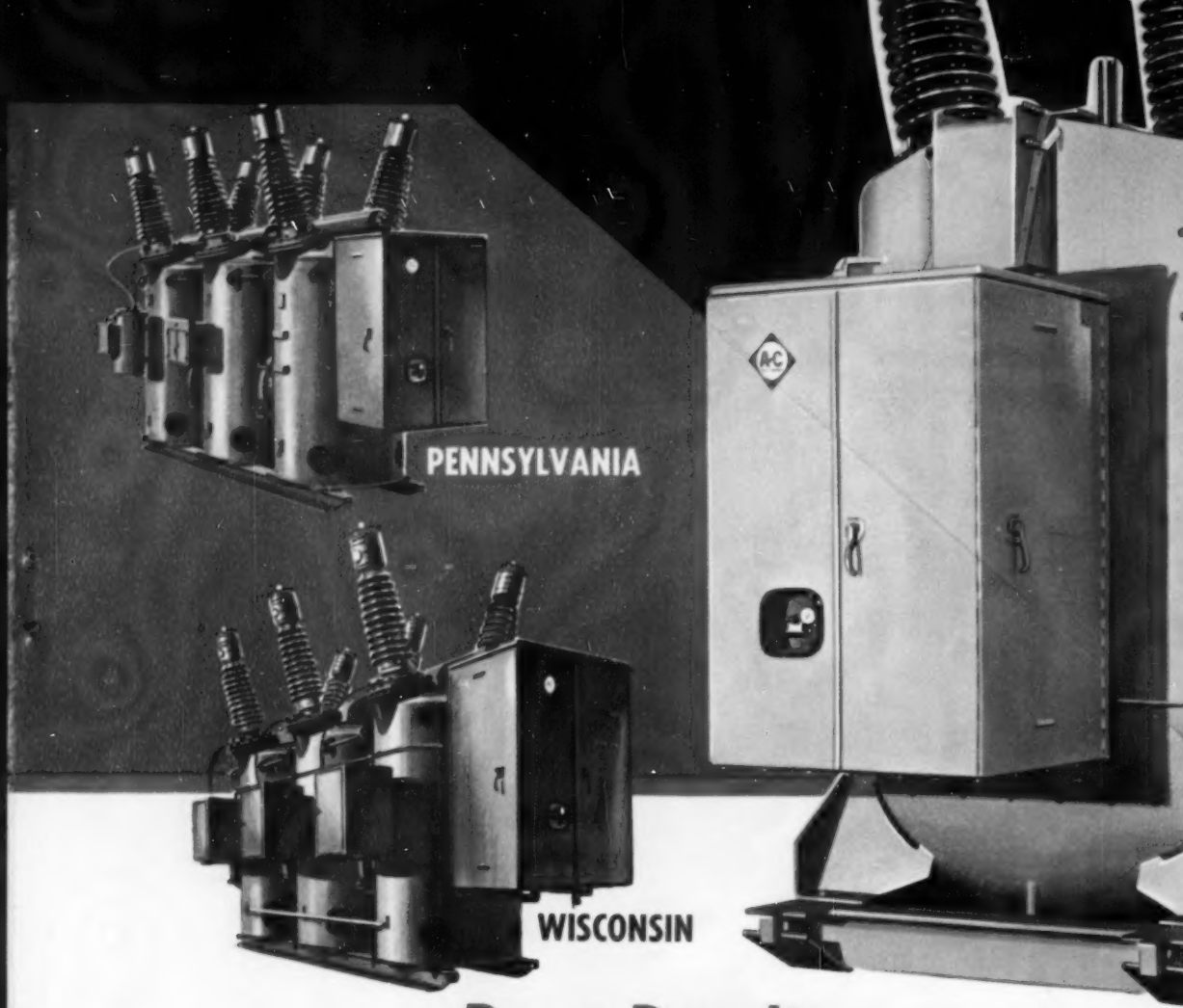
What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how *tempered* glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Insulator Division, Owens-Illinois, Dept. EW-9, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (I) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

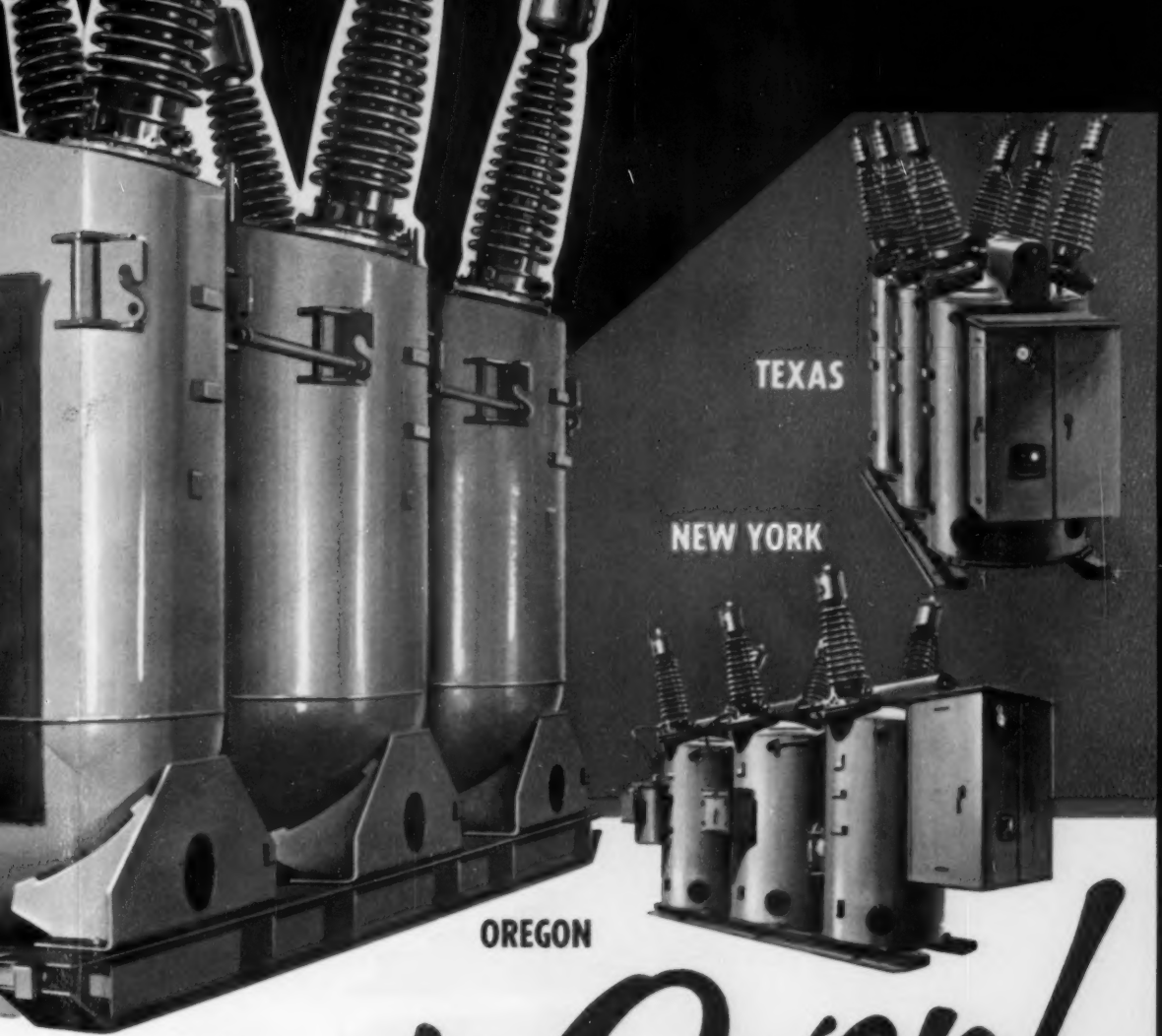
From
Oregon to New York
Texas to Wisconsin...
There is Something
NEW for UTILITIES
See inside
A-4657



Pneu-Draulic
Circuit Breakers are

"Showing U

ALLIS-CHA



...up" all Over!

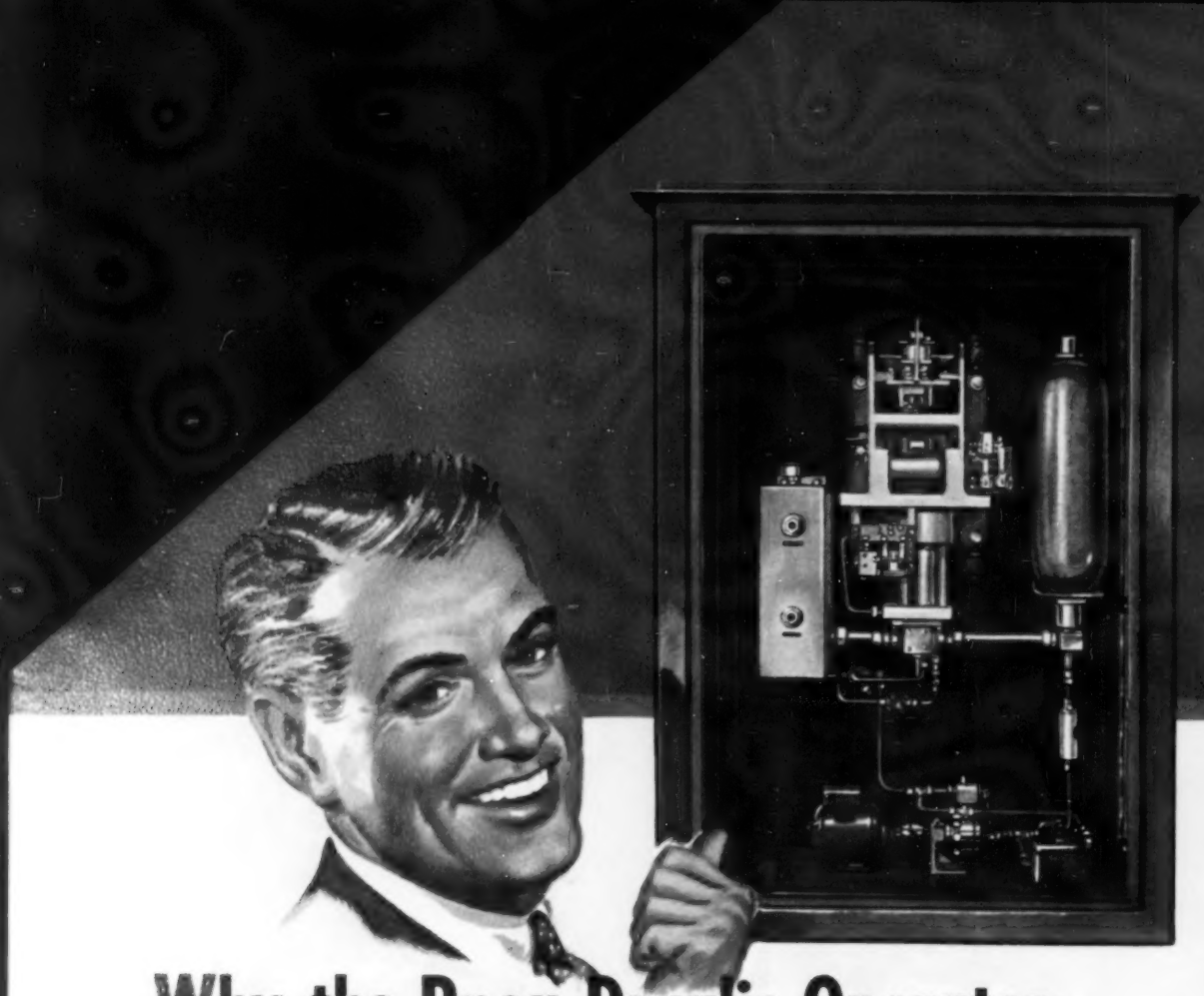
. . . and the big breaker above is one of the latest. It's the world's largest hydraulically operated breaker. *Here are a few facts about it.*

- Rating — 230 kv, 10,000,000-kva interrupting capacity.
- Operating mechanism — fast, simple *Pneu-Draulic* operator.
- Interrupting device — *Turbo Jet* interrupter for fast interruption on both high current faults and low current switching.
- Mechanically trip-free — to allow contacts to open at full rated speed under *all* operating conditions.

Pneu-Draulic and *Turbo Jet* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

...See back page for reasons why it's the best



Why the Pneu-Draulic Operator is the best in any area!

1. Simple — Has fewer parts than other types of operating mechanisms.

2. Unaffected by Temperature — Whether it's hot or cold, the energy stored in the system provides more than standard number of operations. Use of oil with constant viscosity over wide range of temperatures insures uniform performance.

3. Eliminates Moisture and Corrosion Problems — Entire system is filled with oil containing inhibitor which eliminates rust, freezing and corrosion.

4. No Dust Problem — Offers the protection of a sealed system. Efficient filtering eliminates dust and dirt problems.

5. Fast — Can be set to release faster than any present standard.

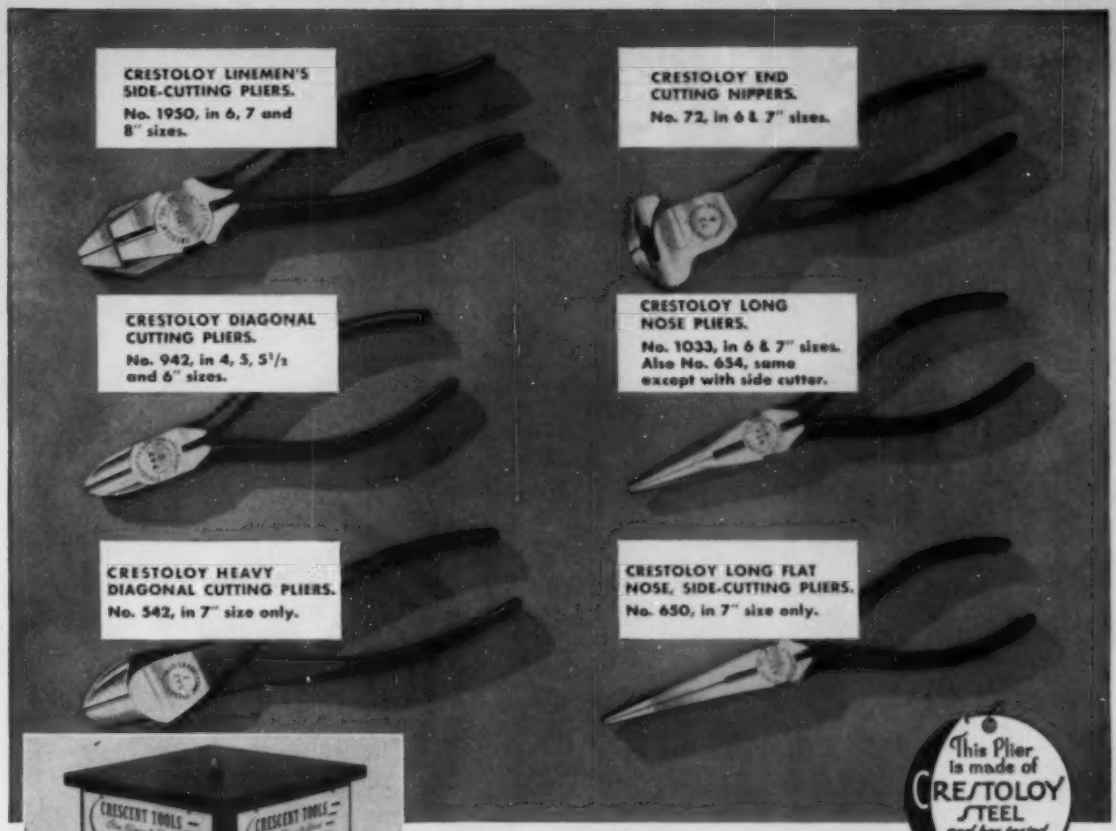
6. Emergency Closing—Can be closed at full speed onto energized line even when no control power is available.

7. Mechanically Trip-Free — Only in mechanically trip-free breakers are contacts and mechanism uncoupled — enabling contacts to open without restriction from mechanism.

It's tried, it's proved! Try it on your system. Compare it to the other circuit breaker operators. For information call your nearby A-C office now, or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 71B7942.

ALLIS-CHALMERS

Milwaukee 1, Wisconsin


CRESTOLOY LINEMEN'S SIDE-CUTTING PLIERS.
No. 1950, in 6, 7 and 8" sizes.
CRESTOLOY END CUTTING NIPPERS.
No. 72, in 6 & 7" sizes.
CRESTOLOY DIAGONAL CUTTING PLIERS.
No. 942, in 4, 5, 5 1/2 and 6" sizes.
CRESTOLOY LONG NOSE PLIERS.
No. 1033, in 6 & 7" sizes. Also No. 654, same except with side cutter.
CRESTOLOY HEAVY DIAGONAL CUTTING PLIERS.
No. 542, in 7" size only.
CRESTOLOY LONG FLAT NOSE, SIDE-CUTTING PLIERS.
No. 650, in 7" size only.

This Plier is made of CRESTOLOY STEEL and has tested 100% satisfactorily

Your hardware dealer carries a wide selection of Crescent and Crestoloy Tools. You cannot buy finer tools at any price.

CRESTOLOY PLIERS

are individually tested!

Crestoloy Pliers take all the guesswork out of plier buying, because Crescent has taken all the guesswork out of plier making. Rigid specifications establish the material, design, workmanship, tests and inspection of these better tools. Strict adherence to these specifications is maintained by continuous tests and relentless inspection of the *individual* tools. Every plier carries the Crestoloy tag certifying that it has been individually tested.

CRESCENT TOOLS
Give Wings to Work
®
Sign of the Artisan
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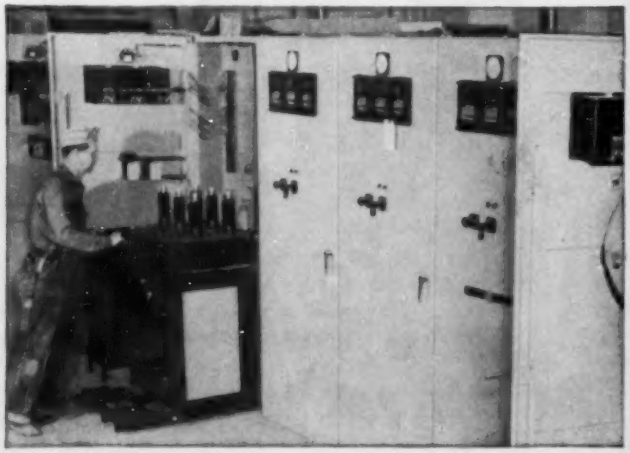
Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

RUNAWAY SHORT CIRCUITS can destroy property, halt production. The fire that started in this switchboard shut down power supply for 19 hours, damaged building, injured personnel.

DRAMATIC TEST shows what happens when switchgear interrupting capacity is inadequate. Here, deliberately tested far beyond its limits, switchgear exploded in G-E laboratory experiment.



IMPROVED PROTECTION offered by a modern G-E metal-clad switchgear installation is your assurance of maximum personnel safety and production continuity. For a vital job like this, only the best is good enough.

Obsolete Switchgear Can Cripple Your Plant

Protect your personnel, equipment, production by modernizing with G-E metal-clad switchgear

Your switchgear is "obsolete" when potential short circuits exceed its interrupting capacity. Under these conditions it can literally explode. Are you sure you have adequate interrupting capacity? Chances are your plant electrical load has gone way up since your switchgear was originally installed. If so, you need to make a careful reappraisal of your switchgear installation. Any compromise in protection here may turn out to be dangerous to personnel and expensive in terms of damaged equipment and lost production. That's why you can't afford less than the best.

FOR THE BEST IN PROTECTION, modernize your switching centers with new General Electric Metal-clad Switchgear. A modern G-E installation works for you six ways to:

- reduce fire hazards to life and property
- reduce electrical hazards to operators and maintenance men
- save delay and expense in procuring obsolete renewal parts
- minimize service interruptions
- assure production continuity
- make future electrical expansion easy

FOR COMPLETE DETAILS ask your nearest G-E Apparatus Sales Representative for Bulletin GEA-5664, or write to General Electric Company, Schenectady 5, New York. 331-12

Progress Is Our Most Important Product

GENERAL ELECTRIC

GUY FIXTURES

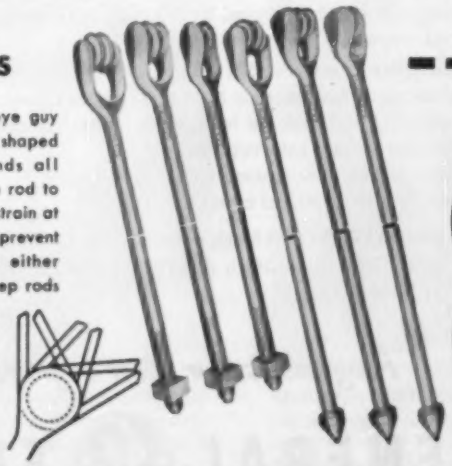
You can save time by making up guys on the ground, save and protect guy strand by using Chance guy fixtures. The full-rounded Thimbleye gives complete strand protection at any angle of pull during slack pulling operations and when in use. Chance fixtures are drop forged from high grade steel, and are heavily galvanized. The line includes Straight and Angle Thimbleye Bolts, Angle Thimbleyes, Thimbleye Nuts, Straight Away and Down Guy Loops, Guy Wire Clips, Curved Washers and Plates.

GUY GUARDS

Only Chance offers such a complete line of guy guards: The SURE-GRIP, with no loose parts to lose—nothing to take apart and re-assemble. The MONO-BOLT, that combines safety, durability and economy with simple installation—only one nut to tighten. The MATTHEWS, a one-piece protector that bolts to the guy clamp and that cannot turn or twist when installed.

GUY RODS

Choose Chance Thimbleye guy rods—with the perfectly shaped "thimble" that extends all around the head of the rod to protect the cable from strain at any angle of pull and prevent kinking. You can get either threaded or Never-Creep rods with Thimbleye, Twin-eye, or Tripleye heads for use with one, two, or three guy strands.



Man... this book can help you "dig" anchors better ... get yours TODAY!

Give the GUY a CHANCE

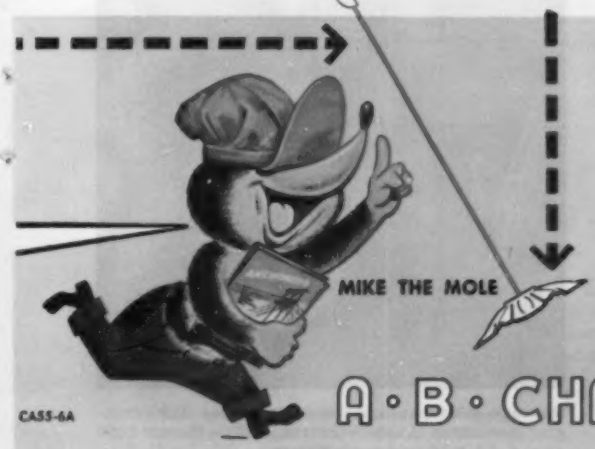
FOR THE BEST IN GUYING

Look to Chance for *all* your guying needs... You can choose an anchor for every soil or guying condition from the most complete line in the industry... add years to guy strand life with the full-rounded Thimbleye on Chance guy rods and fittings... select the guy guard to fit the job... and finish the job with Chance Guy Fixtures. You can get 'em all from one source—your Chance Distributor. For fast service plus the *best* in guying—*give the GUY a CHANCE!*

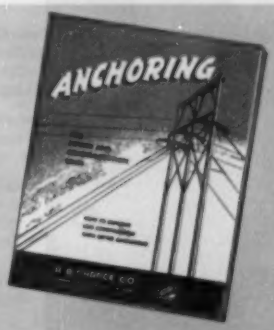
CHANCE 8-WAY ANCHORS

The 8-Way holds far more than its rated load because its eight blades expand to form a complete pyramid shaped square—no wasted space between blades. The load is distributed to all eight blades all around the hole.

8-Way Anchors are available in sizes from 60 to 200 sq. in. in area, for distribution and transmission line guying.



MIKE THE MOLE

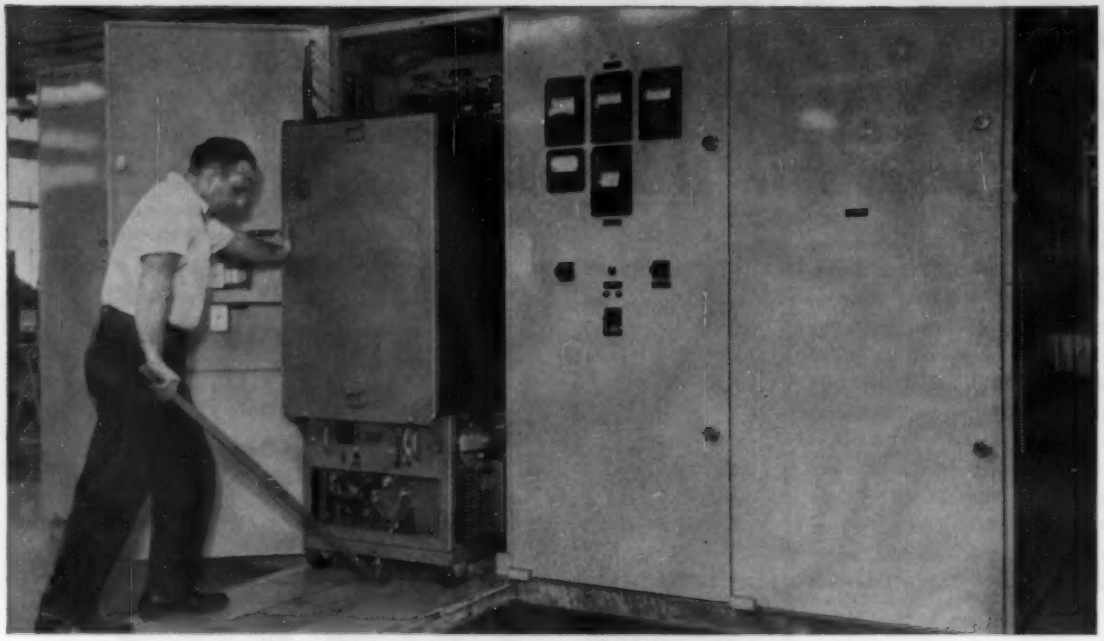


Here is the most complete guide to better anchoring ever developed. It's chock full of how-to-do-it material to help you select the right anchor for every guying job and install it properly. It's FREE!

CASS-6A

A·B·CHANCE CO· CENTRALIA MISSOURI

SAN FRANCISCO, CAL.



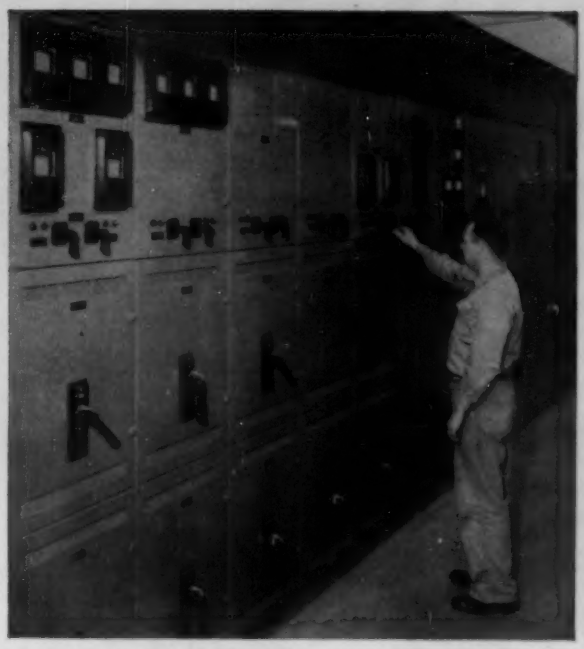
Metal-clad switchgear. Horizontal drawout air circuit breakers in rigid, all-welded enclosures. Available in ratings from 2400 v through 15 kv—50 through 500 mva interrupting and 2000 amp continuous.

NEW CONSTRUCTION ECONOMY TIP:

Isolated phase, metal-enclosed bus. For power generating stations. Available in ratings through 69 kv and 10,000 amp.

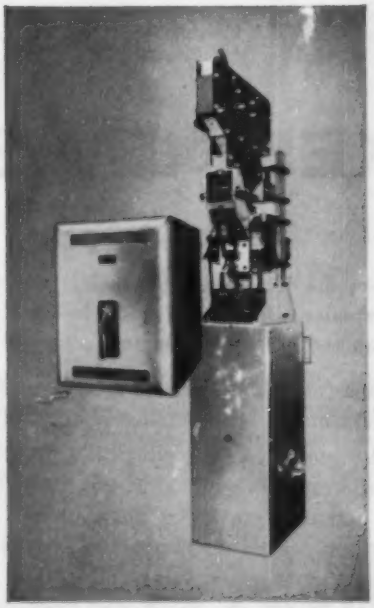
Nonsegregated phase, metal-enclosed bus. For switchgear connections. Available in ratings 600 v through 6000 amp; 5, 7.5 or 15 kv through 5000 amp.

Unit substations. I-T-E primary and secondary unit substations can be supplied for any application—indoor and outdoor—and in any standard rating.



Low voltage switchgear. For circuit protection. Commercial buildings, manufacturing plants, generating stations. Ratings through 600 v a-c, 250 v d-c, 6000 amp continuous, 15,000 through 150,000 amp interrupting.

BUY AN I-T-E "POWER PACKAGE"



Individual breakers. I-T-E large air circuit breakers are available in a wide range of types and ratings, 600 v a-c, 250 v d-c, 750 v d-c.

Coordinated engineering, delivery and installation means a better investment

An I-T-E "power package" includes the complete power handling facilities you need for a new construction project, building addition, or simple expansion of electrical service—one unit or a complete system for every application from generation to end use. You save many ways:

Sound planning. Talk with your local I-T-E application engineer about your general power requirements before you build. He'll work with you to determine the equipment needed to assure complete protection with greatest economy in total investment, operating costs, and construction time.

Easier installation. Before you begin construction, I-T-E will supply you with arrangement and channel base drawings. Equipment is factory assembled, tested and ready to install. Standardized frames and panel elements assure that future additions to your switchboard will match and line up.

Coordinated delivery. Shipments are made from I-T-E according to a predetermined schedule. Each part of the complete "power package" is delivered to the job when needed. This saves delays and eliminates inconveniences.

Assured performance. Since I-T-E will supply all equipment—pre-engineered—you are saved the work of coordinating equipment of different manufacture. You can be sure that the separate parts of an I-T-E "power package" will fit and function together.

For details, contact the I-T-E sales office nearest you—look in your classified directory under "Electric Equipment." I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY
Switchgear Division

ANACONDA MAKES NEWS

A new reduction plant—a new modern mill—five separate fabricating aluminum mills—an engineering organization with years of experience in industry problems—*all* assure completely integrated service for users of the white metal.

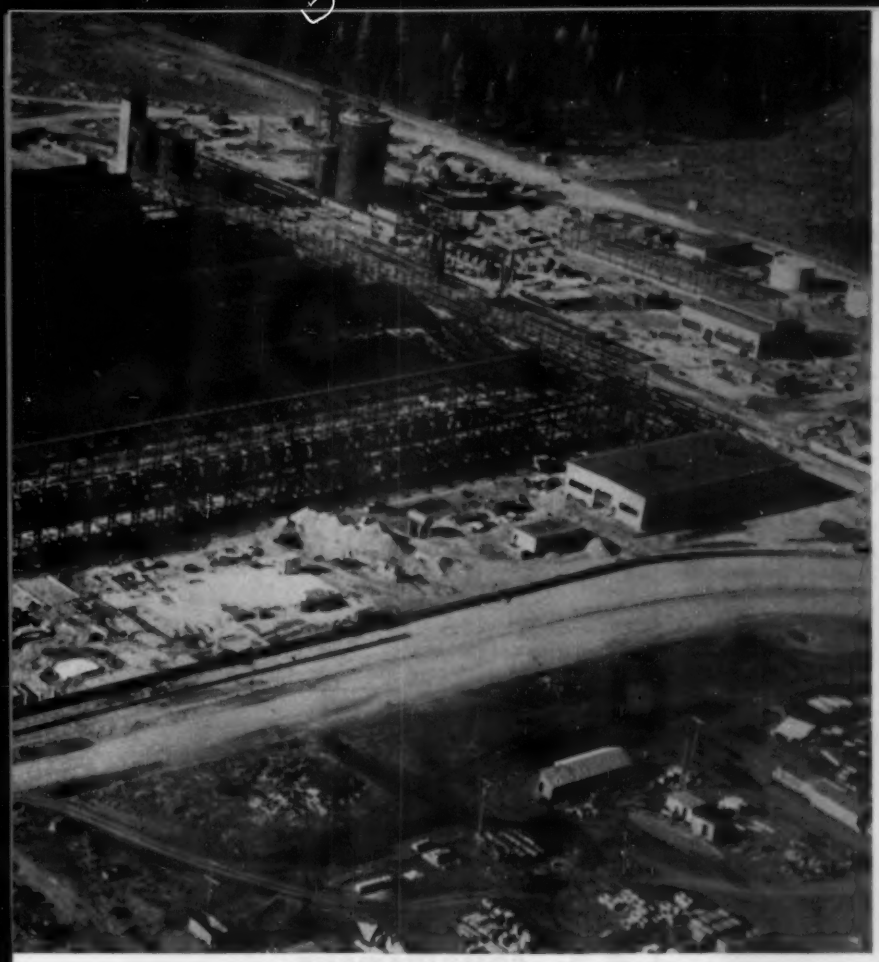
Anaconda's five aluminum wire and cable fabricating mills today have two new big brothers.

One is the imposing new plant shown above—Anaconda Aluminum Company's new reduction plant at Columbia Falls, Montana. It will provide Anaconda with its own major source of primary aluminum—120,000,000 pounds of the white metal a year.

The second is Anaconda Wire & Cable Company's new aluminum rod-rolling mill at Great Falls, Montana (at right). This mill is the most advanced in the country. It is completely automatic.

Today, Anaconda's five strategically located aluminum wire and cable mills . . . together with Anaconda's national *network of distributors* . . . make certain you get the aluminum wire and cable you want—*where* and *when* you want.

Quality products are a tradition with Anaconda. The most modern aluminum facilities in the country are backed by long years of experience with



REDUCTION PLANT of the Anaconda Aluminum Company at Columbia Falls, Montana, is soon to give Anaconda control over its aluminum production from reduction of alumina . . . to ingot . . . to finished product.

ANACONDA ALUMINUM WIRE & CABLE

Bare aluminum
ACSR
Neoline* weatherproof
Duraline* weatherproof
Braid weatherproof
Polyethylene line wire
Type K service drop
Type N-SD service drop

*Reg. U. S. Pat. Off.

IN ALUMINUM

many metals . . . with *all* types of transmission and distribution wire and cable.

For all your aluminum wire and cable . . . for the highest quality aluminum products today . . . for engineering assistance at every stage . . . you can look with confidence to Anaconda. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

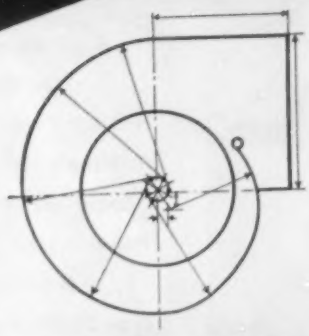
66272

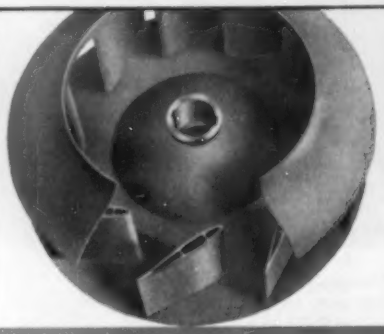
ANACONDA®

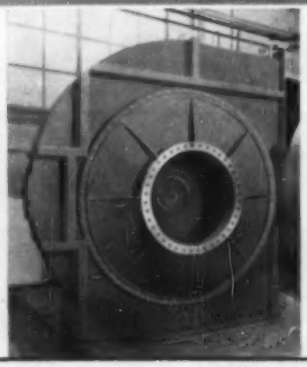
ALUMINUM WIRE AND CABLE

NEWEST IN THE UNITED STATES is Anaconda's modern aluminum rod-rolling mill at Great Falls, Montana. In addition to rod mill, the building houses the latest wire drawing and stranding equipment.

GREEN *Airfoil type* DRAFT FAN







6 DIFFERENT DESIGNS

MANY VOLUME-PRESSURE COMBINATIONS

Thus you can obtain from Green not only the modernized 1955 version of the AIRFOIL Type of Fan made by us back during the World War 1 era but you can probably get much closer to your actual draft requirements *at high guaranteed efficiencies* than with other types of fans.

Six different designs provide a dozen combinations of diameter, width, shroud angle, blade angle, blade length and other influencing factors. You will be getting exactly what you need in the way of volume, pressure, and speed at the most efficient point.

When writing for complete details of the modernized redesigned line of Green GALEX AIRFOIL Type Draft Fans, tell us as much about your requirements as you can disclose at this time. It will help us to choose the best GALEX Fan for your anticipated draft problem.

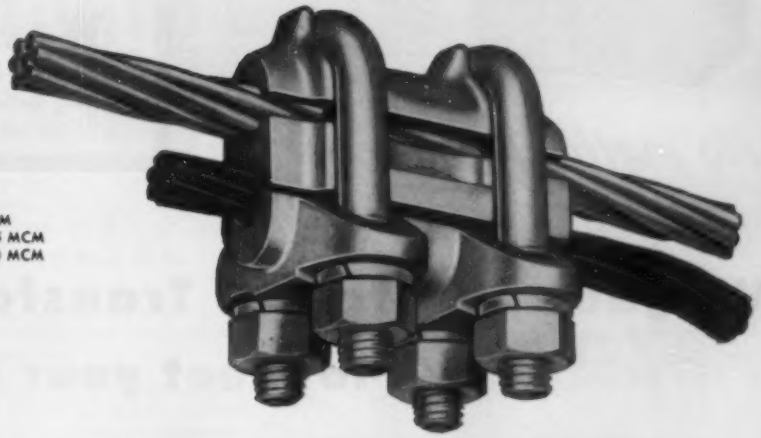
GREEN *THE AIRFOIL TYPE FAN* Galex FAN

GREEN
POWER AND PROCESS PLANT EQUIPMENT

FUEL ECONOMIZER COMPANY,
BEACON 3, NEW YORK

CORROSIVE SOLDERING ELIMINATED!

in BLACKBURN'S Heavy Duty Bi-Metallic Connectors

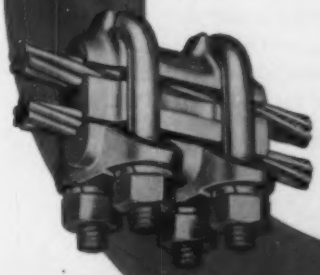


Sizes available to accommodate ACSR 2—336.4 MCM Alum. 1 Str.—397.5 MCM Copper 4 Str.—250 MCM

PRESSURE SEALED, SHRINK-FIT COPPER LINER
SEALS OUT AIR AND MOISTURE—PERMANENTLY!

- Manufactured under controlled atmospheric conditions!
- Eliminating corrosive solders and fluxes between copper liner and aluminum casting insures permanent high conductivity.
- Factory applied protective coating prevents oxidation of contact spacer grooves during transit and storage.
- Castings are high-strength, heat-treated alloy with exceptionally heavy cross sections.
- Clamping forces are distributed over extra long surfaces—contour of grooves protects conductor.
- All Aluminum hardware is alumilited to prevent seizing—bolt features rolled threads of greater strength.

Sizes available to accommodate ACSR 2—336.4 MCM Alum. 1 Str.—397.5 MCM

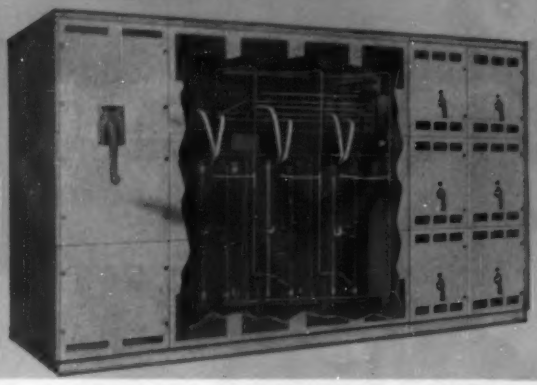


HEAVY DUTY ALL ALUMINUM CONNECTORS

Also available without copper liner for Aluminum to Aluminum. Coefficient of expansion same as conductor. Same high standard of material and construction as above connector.

BLACKBURN Hi-Strength CONNECTORS

JASPER BLACKBURN CORPORATION • 33 MADISON ST. • ST. LOUIS 2, MO.
PHONE MAIN 1-2321



DRY-TYPE

Wagner open, ventilated dry-type transformers are suitable for indoor use only. They are normally installed in a reasonably dry, dust-free atmosphere and in a well-ventilated location. Since they are light in weight, these transformers are often used in multi-story buildings. No fireproof vaults are required when you use Wagner dry-type transformers.

Wagner®
TRANSFORMERS
... the choice of leaders in industry

No matter what your load-center requirements, you can get a

Wagner Substation Transformer *PREDESIGNED* to meet your needs

- ✓ ***save*** **shipment time**
- ✓ ***save*** **job engineering costs**
- ✓ ***get*** **full Wagner Quality with switchgear of your choice**

Wagner "Predesigned" standard unit substation transformers are carefully engineered to meet *heavy* industrial demands—they are not designed for minimum duty only. Predesigning completely eliminates individual job engineering time ... reduces your costs ... and permits quick delivery.

When you specify Wagner "Predesigned" transformers you get the advantages of a proved design in a completely assembled transformer, tested at the Wagner factory. They are built in standard ratings which are coordinated with the specifications of all unit substation builders.

Wagner builds a complete line of substation transformers—open, ventilated dry-type, Oil-Filled, Noflamol, and sealed dry-type Nitrogen-Filled—in ratings from 112½ through 2000 kva, 15 kv and below, to handle practically any distribution requirements.

You can specify the Wagner Transformer that exactly meets your load-center distribution requirements—be assured of full Wagner Transformer Quality—and gain a substantial advantage in delivery time and in cost.

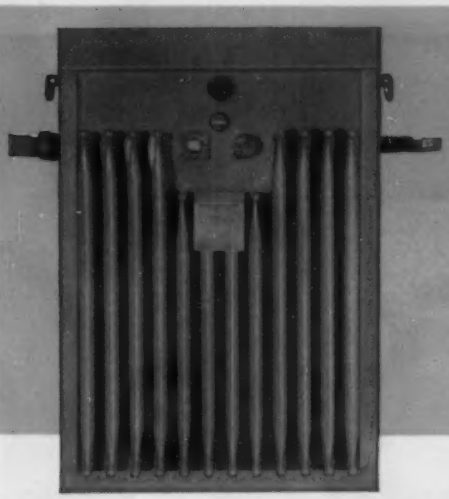
Investigate the many advantages of specifying Wagner "Predesigned" Unit Substation Transformers for your next load-center installation. Consult the nearest of our 32 branch offices, or write direct to us.

Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES



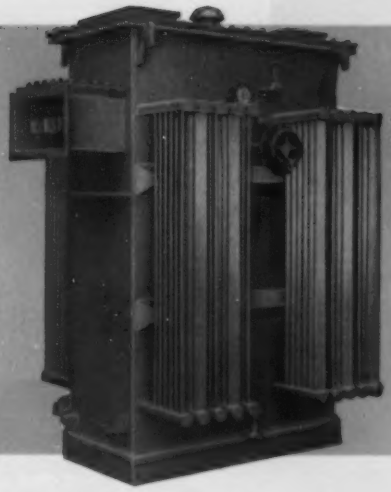
CLOSE-COUPLED DESIGN

This is the close-coupled design which is now available along with standard throat-connected liquid-filled models. The transformer fits flush against the switchgear enclosure, eliminating the throat and saving space. Connections are made at the bushings on the sides of the transformer. The close-coupled design is available in ratings from 500 through 2000 kva.

LIQUID-FILLED

Oil-filled transformers are generally installed outdoors, although they can be used indoors if suitable fireproof vaults are provided.

Noflamol transformers are filled with a non-inflammable synthetic liquid, and can be built for indoor or outdoor installation. Noflamol transformers are used in all types of plants, but they are especially suitable for chemical plants, refineries or other locations where explosive liquids or gases are present.



NITROGEN-FILLED

Wagner's sealed dry-type nitrogen-filled transformers offer many advantages in maintenance and safety. They are suitable for indoor or outdoor use—covers are welded to the tanks. They require only a minimum of maintenance—they present no cleaning problems, even in dust-filled areas. They are completely fireproof. Wagner nitrogen-filled, Class H Silicone Insulated Transformers are available in ratings up to 2000 kva.

TSS-3

Write for Wagner Bulletin TU-205. It gives full information on Wagner Unit Substation Transformers for industrial power distribution systems.

Ljungstrom field engineers assure you of maximum return on your preheater investment

Your Air Preheater Corporation field engineer aims to visit your installation at least once a year. It's his job to give you the help and advice you need to assure you of maximum return on your Ljungstrom Air Preheater investment.

This field service is another factor in making the Ljungstrom the most economical heating surface on the modern boiler. And it helps explain why 7 out of 10 modern preheater installations are Ljungstroms.

Get all the details on the Ljungstrom Air Preheater. Why it cuts fuel costs . . . helps maintain higher boiler efficiencies. . . . why it speeds cleaning and maintenance. You'll find all the details in the new, 38-page reference manual, "Ljungstrom Air Preheaters." Write for your free copy, today!

Advantages of the Ljungstrom Air Preheater

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

For High Q and Excellent Capacitance Stability

CP

PLASTICON CAPACITORS are made with NATVAR Styroflex®

CP Plasticon Type P Capacitors are available with metal can containers in 22 capacities ranging from 0.1 mfd at 1000 vdc to 25 mfd at 100 vdc; and with tubular "Glass-mike" containers in 22 capacities from .001 mfd at 1000 vdc to 1.0 mfd at 100 vdc.

Capacitors designed and manufactured by Condenser Products Co., Division of New Haven Clock & Watch Co. are extensively used in calculators, computers, integrating circuits, electronic controls, sawtooth oscillators, and other equipment where stability and low dielectric loss are important.

Natvar Styroflex film is used as the dielectric because it has all of the outstanding properties of polystyrene, plus complete flexibility due to bi-axial orientation during the manufacturing process.

If you need an insulating material with the desirable characteristics of polystyrene—plus flexibility, it will pay you to investigate Natvar Styroflex. Ask for new data sheet ST-1, just off the press.

Natvar

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Vinyl coated—varnished—lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 23

NATVAR CORPORATION

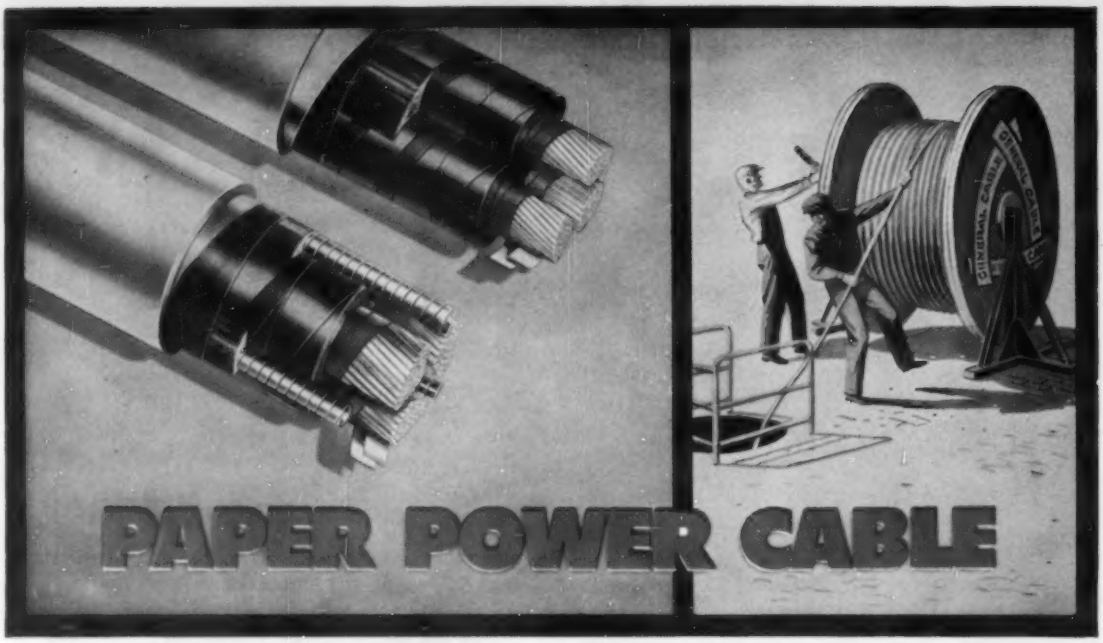
FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE RAHWAY 7-8800 — CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

GENERAL CABLE

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE



Pioneers in the development of Paper Power Cables, General Cable Engineering leadership and manufacturing skill is combined to provide a *uniformly high quality product.* Conductors are made to finest possible tolerances, insulations are thoroughly tested and inspected before and after assembly — in fact, *every* step of manufacture is under the most rigid quality control.

The biggest producer, General Cable also makes the widest range of types. For example: solid, low pressure gas-filled, low pressure oil-filled, high pressure oil-filled (pipe type), high pressure gas-filled (pipe-type), and high pressure oil or gas-filled (self-contained).

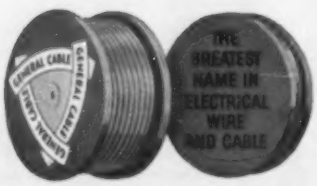
Available in widest range of conductors: Compack Round, Concentric, Compack Sector, Annular Concentric, Compack Segmental, Hollow Core.

Made in largest variety of finishes: Jute, Duck Tape, Reinforced Neoprene, Synthetic Plastics, Flat Steel Tape or Steel Wire Armor.

The forementioned represent but a few of the wide range of types manufactured by General Cable... plus other types made to customer specifications.

Next time you're talking Paper Power Cable . . . or any type of electrical wire and cable, call in your friendly General Cable Representative... there's one near you.

GENERAL CABLE
CORPORATION



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

GENERAL CABLE CORPORATION
Executive Offices: 420 Lexington Ave., New York 17, N. Y.

SALES OFFICES: Atlanta • Baltimore • Boston • Buffalo Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit Erie (Pa.) • Greensboro (N. C.) • Houston • Indianapolis Kansas City • Lincoln (Neb.) • Los Angeles • Memphis Milwaukee • Minneapolis • New Haven • Newark (N. J.) New York • Philadelphia • Pittsburgh • Portland (Ore.) Richmond (Va.) • Rochester (N. Y.) • Rome (N. Y.) St. Louis • San Francisco • Seattle • Springfield (Ill.) Syracuse • Tampa • Tulsa • Washington, D. C.

EASIER TO INSTALL AND MAINTAIN!

mount *1* device instead of *2*

extra-wide gutters

all components accessible from front

plenty of knockouts

SQUARE D COMBINATION STARTERS

(Switch or Circuit Breaker Types)

Save space and time. Mount and wire one device instead of two . . . neater, more attractive installations.

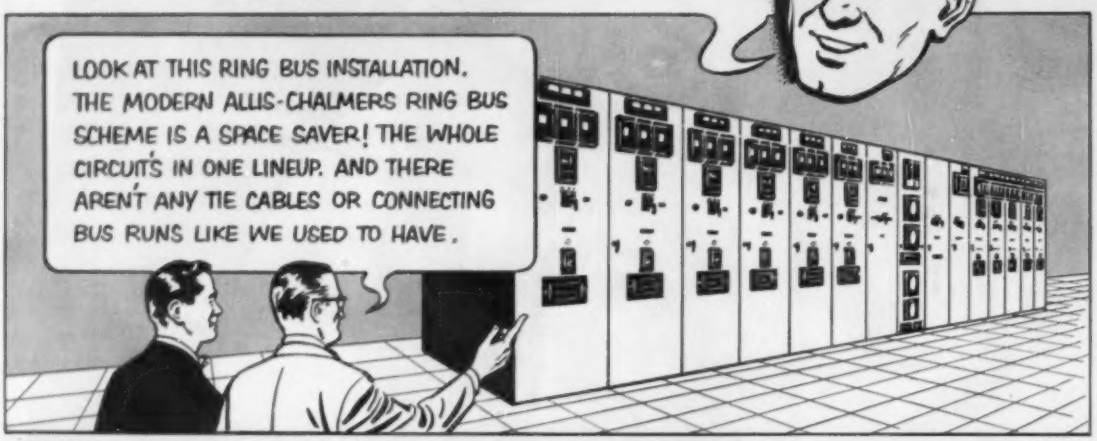
Write for Bulletins 8538 and 8539
Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin

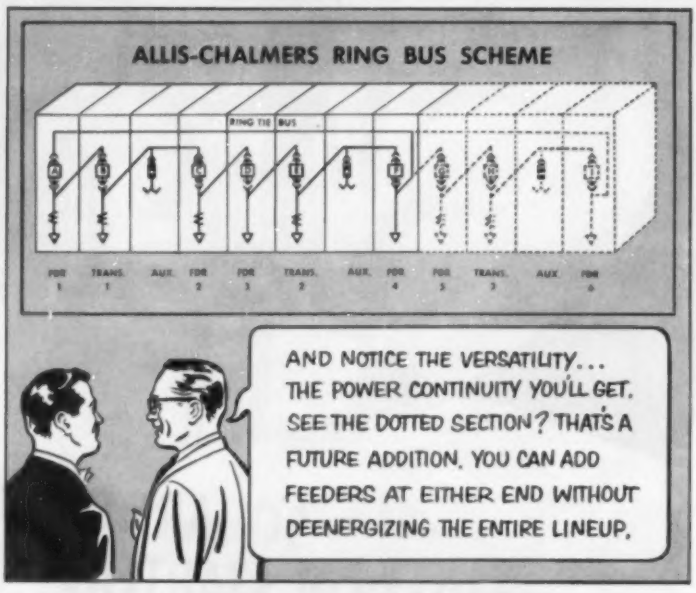
ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

"Jim Showed Me I Was Wrong About the Ring Bus...

I didn't realize it could be so compact...so easy to expand"


LOOK AT THIS RING BUS INSTALLATION. THE MODERN ALLIS-CHALMERS RING BUS SCHEME IS A SPACE SAVER! THE WHOLE CIRCUIT'S IN ONE LINEUP. AND THERE AREN'T ANY TIE CABLES OR CONNECTING BUS RUNS LIKE WE USED TO HAVE.

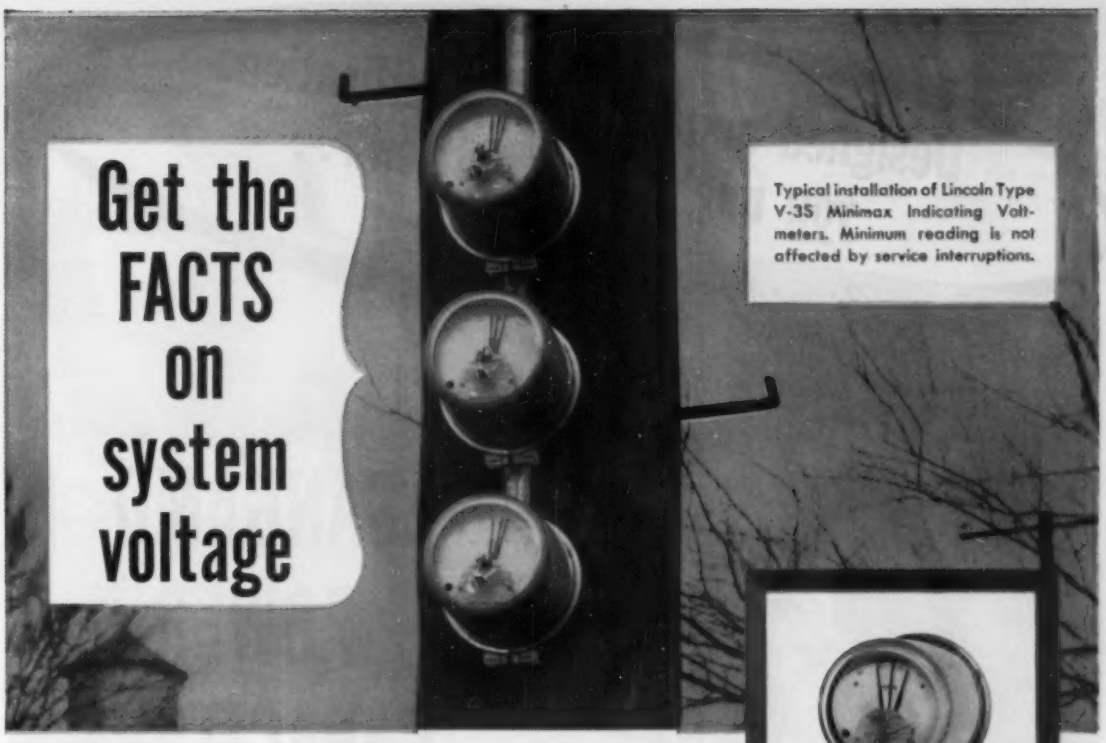

ALLIS-CHALMERS RING BUS SCHEME
RING TIE BUS
AND NOTICE THE VERSATILITY... THE POWER CONTINUITY YOU'LL GET. SEE THE DOTTED SECTION? THAT'S A FUTURE ADDITION. YOU CAN ADD FEEDERS AT EITHER END WITHOUT DEENERGIZING THE ENTIRE LINEUP.

There's More to the Story Ask for the interesting engineering paper "Continuity of Service at Distribution Voltages by Means of Ring Bus." Contact your nearby A-C office or Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4752

ALLIS-CHALMERS

Get the FACTS on system voltage



Typical installation of Lincoln Type V-3S Minimax Indicating Voltmeters. Minimum reading is not affected by service interruptions.

Eliminate costly "surveys" with low-cost permanent installations of rugged LINCOLN THERMAL VOLTMETERS

Continuous knowledge of voltage at check points throughout your system lets you plan necessary changes to provide good customer service *before* difficulties develop.

Lincoln Thermal Voltmeters are an *economical* means of obtaining such knowledge—at substations—on distribution feeders—on secondaries—and even at the customer's premises. These rugged thermal voltmeters give continuous voltage data at low cost. Readings are not distorted by flicker voltage.

The line includes minimum-maximum indicating voltmeters and graphic voltmeters. It also includes an indicating voltmeter combined with a watthour meter in a single case. This combination can replace a conventional socket type watthour meter providing kwh for customer billing and exact knowledge of voltage at the service entrance. Write for complete information on the Lincoln line today.

Type V-2S Indicating Voltmeter, Used where loss of minimum voltage indication because of service interruptions is not a problem.

Graphic Voltmeter. Used where knowledge of time and duration of voltage changes is required.

Type J2WVS Combination kwhr — voltmeter. For continuous knowledge of voltage at service entrance, as well as kwh metering for customer billing.

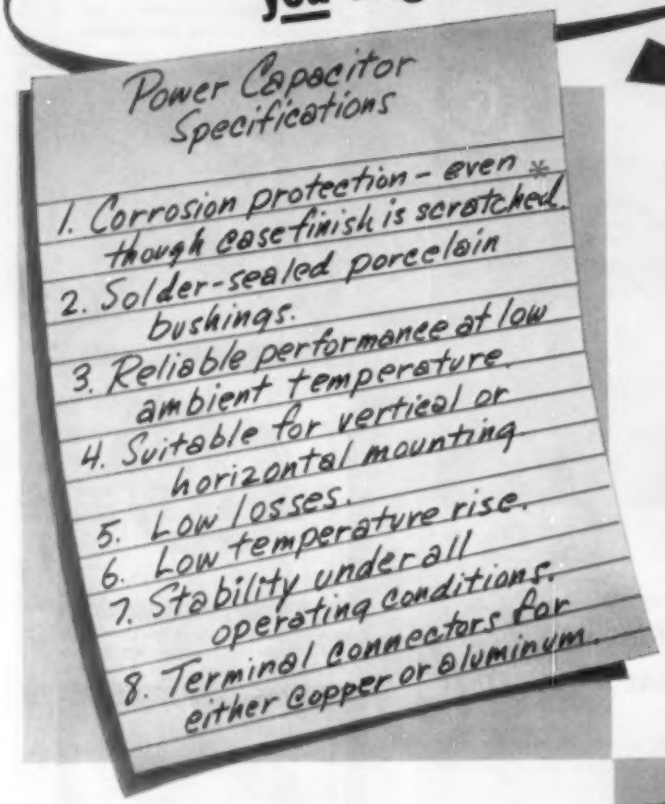
SANGAMO — *Only Measured Facts are Known Facts*

SANGAMO ELECTRIC COMPANY

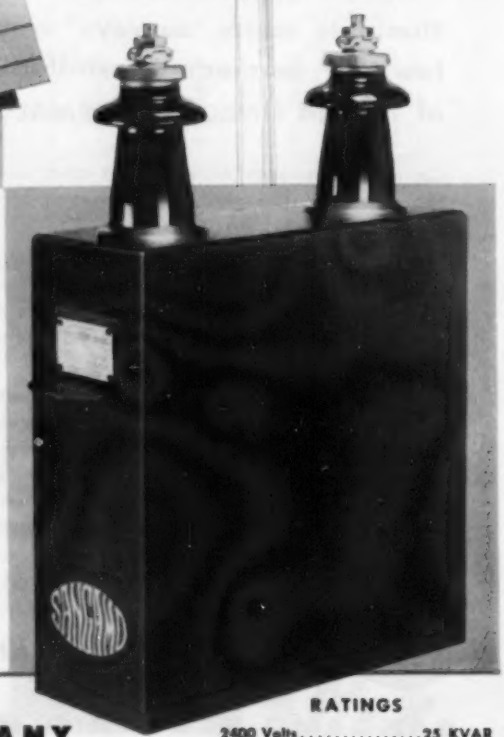
SPRINGFIELD, ILLINOIS

BH 55-2

Designed and built to specifications you might have written . . .


Power Capacitor Specifications
1. Corrosion protection – even though case finish is scratched.
2. Solder-sealed porcelain bushings.
3. Reliable performance at low ambient temperature.
4. Suitable for vertical or horizontal mounting
5. Low losses.
6. Low temperature rise.
7. Stability under all operating conditions.
8. Terminal connectors for either copper or aluminum.

SANGAMO POWER CAPACITORS



* After many talks with utility company men, we know you want your capacitor in a case having corrosion resistance that's more than just skin deep. Sangamo Diaclor Power Capacitors have a case which is metalized with pure aluminum and finished with a two-coat, baked, vinyl resin base paint. Rust and corrosion won't attack this case even if the finish is scratched through to the steel. That's because the aluminum will "sacrifice" itself before rusting occurs.

For more details on other features of the new Sangamo Diaclor Capacitor, write today for Bulletin 1120.

RATINGS

2400 Volts.....25 KVAR
7200 Volts.....25 KVAR
Singlephase.....60 Cycles

SANGAMO

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

PC55-3

After initial adjustments are made, as in photograph, "Mr. Meticulous" automatically performs critical operations in making junction tetrode transistors—tiny experimental devices which may find important uses in the telephone system.

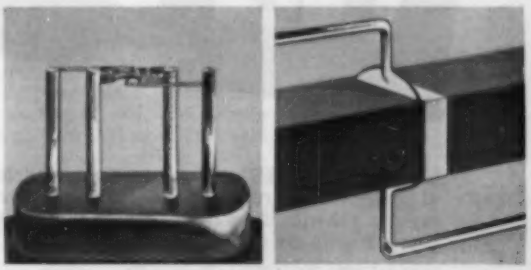
The machine we call "Mr. Meticulous"

Bell Laboratories scientists, who invented the junction transistor, have now created an automatic device which performs the intricate operations required for the laboratory production of experimental model transistors.

It takes a bar of germanium little thicker than a hair and tests its electrical characteristics. Then, in steps of 1/20,000 of an inch, it automatically moves a fine wire along the bar in search of an invisible layer of positive germanium to which the wire must be connected. This layer may be as thin as 1/10,000 of an inch!

When the machine finds the layer, it orders a surge of current which bonds the wire to the bar. Then it welds the wire's other end to a binding post. Afterward, it flips the bar over and does the same job with another wire on the opposite side!

Once only the most skilled technicians could do this work, and even their practiced hands became fatigued. This development demonstrates again how Bell Telephone Laboratories scientists work in every area of telephony to make service better.



Transistor made by new machine is shown in sketch at left above, magnified 6 times. At right is sketch of area where wires are bonded. The wires are 2/1000 inch in diameter, with ends crimped to reduce thickness.

BELL TELEPHONE LABORATORIES

IMPROVING TELEPHONE SERVICE FOR AMERICA PROVIDES CAREERS FOR CREATIVE MEN IN MECHANICAL ENGINEERING

NOW! Lowest Prices!

Highest Powered Dodge Trucks Ever Built!

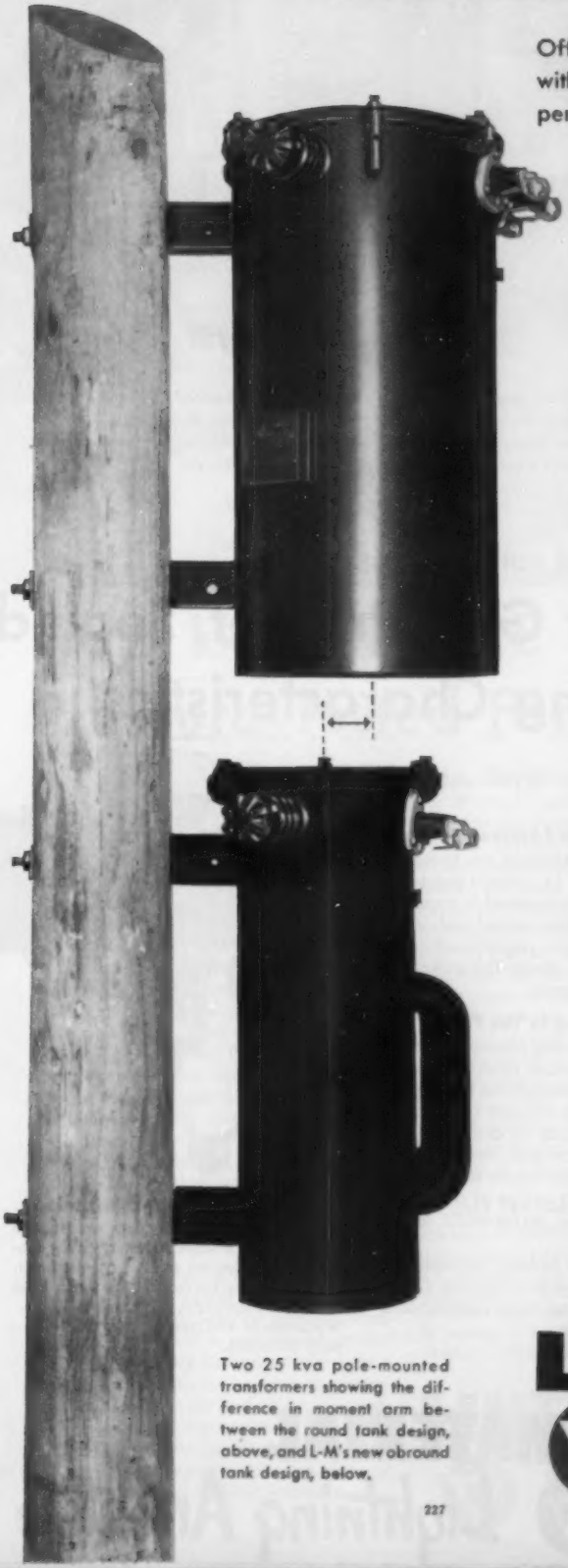
LOWEST PRICES! Many standard models of Dodge trucks are priced lower than all other makes! Yet with these low prices, quality-built Dodge trucks are dependable as ever.

HIGHEST POWER! Power-Dome V-8 engines, with 169 to 202 hp., are the most powerful of any leading trucks. Save time, save on operating costs, with these short-stroke V-8's! You'll save with Dodge thrifty 6's, too!

THE FORWARD LOOK! Now Dodge brings the Forward Look to trucks. New wrap-around windshield (biggest of any make!) means added visibility and safety! More reason why you should look at Dodge before you buy any truck. Why not phone your dependable Dodge truck dealer, today?

DODGE *"Job-Rated"* TRUCKS WITH THE *FORWARD* LOOK!

How L-M's New Obround Design Provides 27% Less Bending Moment



Two 25 kva pole-mounted transformers showing the difference in moment arm between the round tank design, above, and L-M's new obround tank design, below.

Offers 33⅓% increase in transformer capacity on a pole, with no sacrifice of L-M's outstanding Round-Wound® performance characteristics.

L-M's new obround tank design is smaller, lighter, and has a shorter moment arm on the pole. The total bending moment is substantially reduced. Thus the potential capacity of all your transformer structures is greatly increased. L-M's new obround tank design retains all the outstanding Round-Wound performance characteristics.

Less Weight, Shorter Moment Arm

The new obround design has a smaller tank with less transformer oil, resulting in a lighter, easier-to-handle transformer. Cooling tubes are installed where required to provide adequate cooling surface. Transfer of heat from copper to outside air is faster and more efficient because of reduced mass.

The new obround design also reduces the moment arm distance from the pole. The combination of less weight and shorter moment arm distance greatly reduces the total bending moment on the pole.

COMPARE 50 kva *round* tank design and L-M's new 50 kva *obround* tank design:

50 kva ROUND tank design:
Moment arm from center of pole.....1.6 ft.
Weight.....860 lbs.
Bending moment 860 x 1.6.....**1,376 ft.-lbs.**

50 kva L-M OBROUND tank design:
Moment arm from center of pole.....1.33 ft.
Weight.....760 lbs.
Bending moment 760 x 1.33.....**1,010 ft.-lbs.**

L-M's new 50 kva *obround* transformer puts *27%* less bending moment on the pole than the 50 kva *round* tank design. That means that you put less strain on your structures—or you can now hang three 50 kva's where you formerly hung three 37½'s—a 33⅓% increase in capacity.

Round-Wound Performance

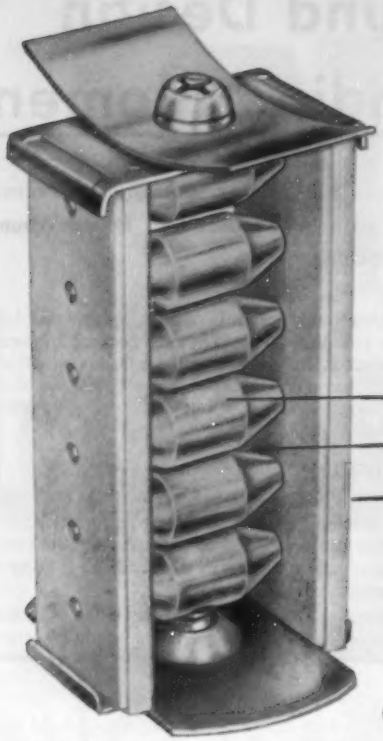
The advantages of less weight and shorter moment arm were accomplished without changing L-M's outstanding Round-Wound performance characteristics. These characteristics include low exciting current, high impulse strength, high short-circuit strength, and high short-time overload capacity.

Get Details on L-M's Obround Transformer

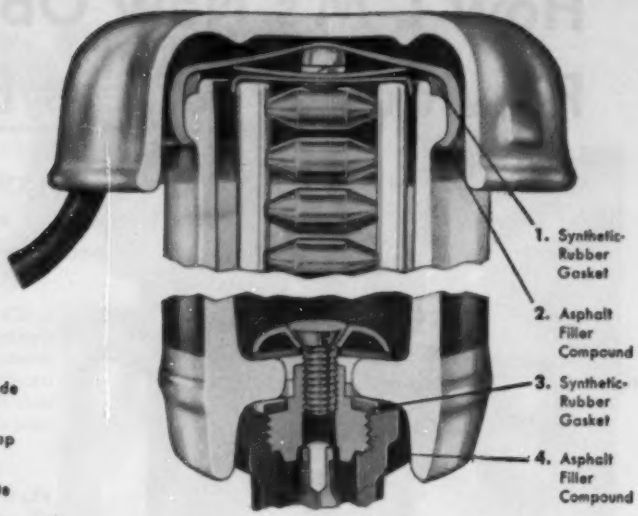
Ask the L-M Field Engineer for application information, weights and dimensions on L-M obround transformers and the exclusive Round-Wound design. Or write A. B. Coyle, Product Manager, Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

LINE MATERIAL

LM® Transformers



L-M's precision spark gap structure is made of electrode members accurately spaced and supported by a frame of high-grade steatite.



Permanently Sealed, L-M's spark gap cannot be knocked or burned out of adjustment. Not affected by weather, corrosion, birds, bugs, etc.

Cannot get out of adjustment...

L-M's Valve Arrester Gap Pre-Set, Sealed, To Assure Unchanging Characteristics

By **ROBERT W. KELLY**
Application Engineer
Protective Equipment
Line Material Company

You can always be sure of optimum balance between 60-cycle sparkover and impulse sparkover with L-M's Valve Type Arrester.

L-M's spark gap is precision made, preset, and then permanently sealed in the arrester housing. It cannot be knocked or burned out of adjustment. It is not affected by weather, corrosion, birds, bugs, etc. The sealing prevents corrosion, and thus prevents radio noise.

Gap of Heavy-Duty Construction

L-M's spark gap structure is a ladder gap design, made of solid brass electrode members. These are accurately spaced and supported by a frame of high-grade steatite. This heavy-duty unit transmits severe discharges without burning or pitting, and allows the arrester to go into action fast.

Permanently Sealed At Each End

The arrester is sealed at the top by a heavy synthetic-rubber gasket between the copper cap and the seat on the housing. The cap is spun onto the glass housing while pressure is applied to compress the gasket.

The bottom of the arrester is also sealed by a heavy synthetic-rubber gasket which is compressed against the glass seat by the Isolator assembly.

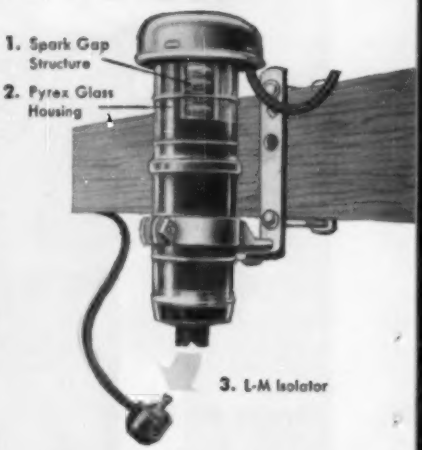
100% Tested For Positive Sealing

All of L-M's Valve Arresters are tested by applying air under 15 pounds pressure, while the arrester is submerged in water, to see whether any bubbles appear, indicating air leaks. Since the valve material is porous, this air-pressure test checks the gaskets at both ends of the arrester.

Visual Testing In The Field

Should the spark gap ever become damaged by any cause, permanent telltale evidence can be readily seen through the Pyrex glass housing. If the valve element is damaged and the spark gap fails to extinguish 60-cycle power follow current, the heat from the additional current across the Isolator gap explodes a small charge of non-aging gunpowder, which is permanently sealed in the Isolator.

This ruptures the Isolator housing and blows the ground lead terminal free, giving complete isolation and ready identification of the faulty arrester.



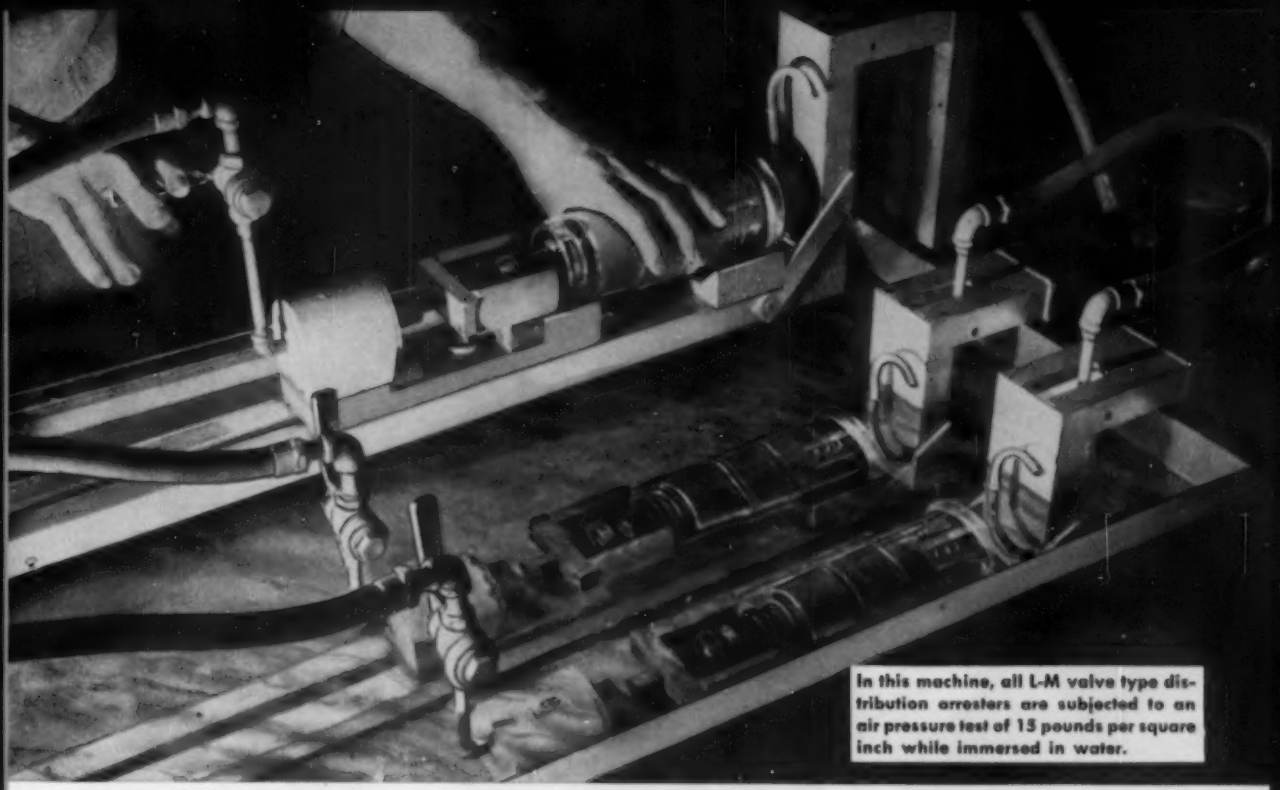
Ask For Complete Information

Ask the L-M Field Engineer for Bulletin LA2 on L-M's Valve Arrester, giving specific information on arrester requirements, design and performance; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

228

Lightning Arresters



In this machine, all L-M valve type distribution arresters are subjected to an air pressure test of 15 pounds per square inch while immersed in water.

How L-M's Type E Valve Arresters Are Pressure-Tested For Positive Sealing

By **M. L. FENNIG**
Application Engineer
Protective Equipment
Line Material Company

All of L-M's valve type distribution arresters are pressure-tested to assure a positive seal against moisture. After the arrester is assembled, except for glass cap and wire lead, air under 15 pounds pressure is applied through a small V-cut in the copper cap. While under pressure, the arrester is held under water to see whether any bubbles appear, indicating air leaks. Since the valve material is porous, this air pressure test checks the gaskets at both ends of the arrester. After the test, air pressure is released, the opening is solder-sealed, the lead and the glass cap are attached.

Heavy Seals At Each End

Top of the arrester is sealed by a heavy synthetic-rubber gasket between the copper cap and the seat on the housing. Pressure on the gasket is maintained permanently by spinning the copper cap over a flange on the glass housing, while the assembly is under pressure in a hydraulic press. • The bottom of the arrester is also sealed by a heavy synthetic-rubber gasket which is held in place against the glass seat and compressed by the Isolator assembly.

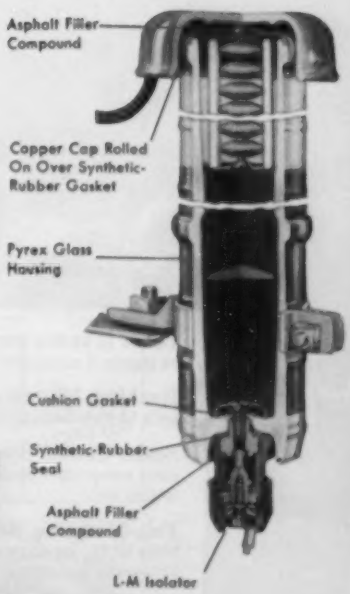
Visual Testing In Field

No electrical testing is required to determine the condition of L-M's Type E valve arrester, because it is in a *glass* housing. Visual inspection is the complete test! Should the spark gap be damaged by any cause, permanent telltale evidence can be readily seen through the Pyrex glass housing. In the rare cases when the valve element may be damaged by overvoltage or direct strokes, or the spark gap fails to extinguish power follow current, the Isolator will operate.

L-M's Isolator gives positive assurance against grounding feeders by disconnecting the ground lead from the arrester if the arrester should ever become damaged. It also provides the lineman with a visual indication of a damaged arrester.

Ask For Complete Information

Ask the L-M Field Engineer for Bulletin LA2 on L-M's Type E arrester, giving specific information on arrester requirements, design and performance; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



LINE MATERIAL
Lightning Arresters

Leads of 48-inch 600-volt #12 wire furnished as standard equipment.

Bushing-Mounted Indicating Fuse with 48-inch lead can be supplied.

Solder-Sealed Bushings of strong one-piece wet-process porcelain provide a positive, lasting seal.

Pole-Mounting Bracket has two 9/16" holes for ½" lag screws. Standard EEI-NEMA crossarm-mounting bracket furnished if required. Capacitor can be mounted with bushings up or down.

Aluminum Metallizing process protects steel tank from oxidation; is followed by a chromate primer and a finish coat of alkyd resin paint.

Single-Pack, Round-Tank Design makes these capacitors small, light, easy to install. Unit has a one-minute discharge resistor; is completely impregnated under vacuum with low temperature Elemex liquid dielectric.

LM® LINE MATERIAL

Left: L-M's 5 kvar is 18⅝" high, weighs only 25 lbs. The 3 kvar is 13⅜" high, weighs 18 lbs. These weights include the pole-mounting brackets. Standard EEI-NEMA crossarm-mounting bracket furnished if desired.

L-M's unique shipping carton permits inspecting and testing capacitors without removing them from the carton, simply by opening the end flap—which can be resealed.

Small, Light, Easy to Install . . .

L-M's New Secondary Capacitors Provide Needed Vars For Air-Conditioning Loads

Solder-sealed bushings, aluminum metallized finish on tank, and single-pack construction assure long life, low maintenance.

By **BLAINE SCHULTZ**
Section Engineer
Capacitors
Line Material Company

L-M's new secondary capacitor is your solution to the problem of poor voltage regulation and overloaded transformers caused by low-power-factor air-conditioning loads.

The unit is small, light, and rugged; easy to install on crossarm or direct pole mounting. It offers you outstanding design features, such as aluminum metallized tanks, solder-sealed bushings, one-minute discharge resistor, single-pack round-tank construction, and low-temperature Elemex liquid dielectric.

Protective Coating

L-M's unique aluminum metallizing process prevents oxidation of the steel tank and greatly extends the life of the capacitor. This process is followed by a chromate primer and a finish coat of alkyd resin paint. The finish coat is dark in color to facilitate heat radiation and keep the capacitor at low operating temperatures.

Solder-Sealed Bushings

Strong solder-sealed bushings of one-piece wet-process porcelain provide a positive, lasting seal. By eliminating gaskets and clamps we eliminate leakage. Therefore the capacitor can be mounted with bushings up or down.

Pack Construction

The packs are assembled in air-conditioned rooms to assure uniformity and are tested with over-voltage to eliminate any actual or potential defects. The units have a one-minute discharge resistor to assure safe handling and storage.

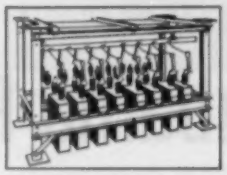
L-M's new 240-volt, pole-mounted, secondary capacitors are available in 3 and 5 kvar. 48-inch leads are furnished and external bushing-mounted indicating fuses can be supplied when required.

Ask us for complete information

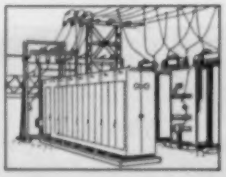
Ask the L-M Field Engineer for complete information on construction and application of L-M's secondary pole-mounted and submersible capacitor equipments, 2400- to 13,800-volt equipments, and our capacitor bank engineering service. Or write Mr. Delaney at Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Other L-M Capacitor Equipments

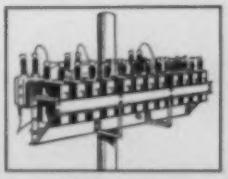
L-M offers a complete line of power capacitor equipments, such as these:



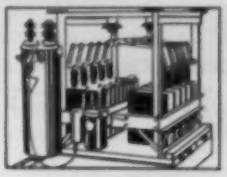
Factory-assembled blocks, which save time and money in building large banks.



Metal-enclosed capacitor equipments in all NEMA-standard sizes and ratings.



Factory-assembled racks for pole-mounted banks, both three-row and single-row styles.



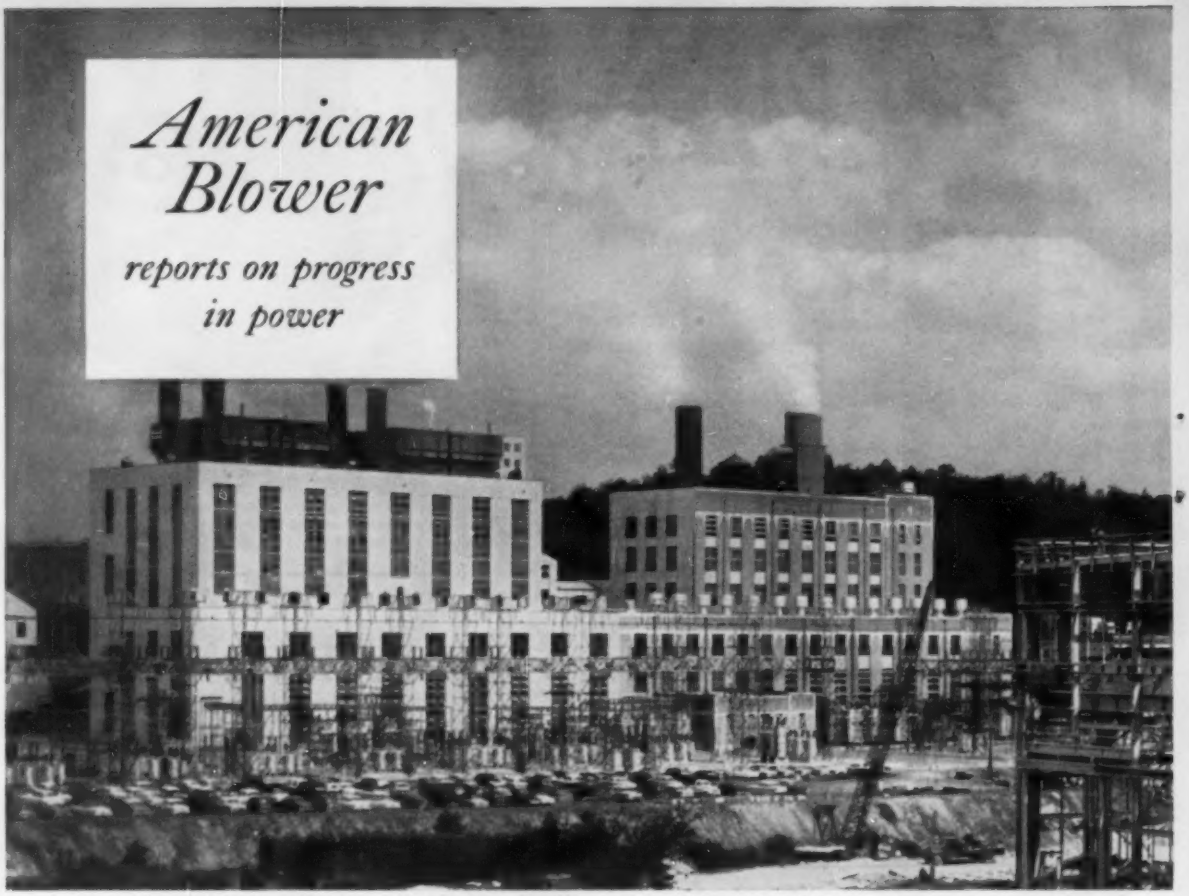
VDS-Method factory-assembled block for multi-step bank switching—an exclusive L-M method that offers a substantial saving on switching equipment.

Also custom-designed protective and switching schemes.

Elemex® Capacitors

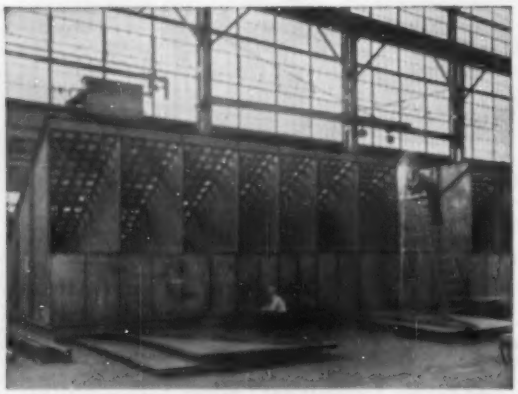
American Blower

reports on progress in power



Gorgas Steam Plant No. 2, with 428,000 hp capacity, is on the Warrior River. Plant No. 3 (right), under construction, will house

Alabama Power ups capacity to



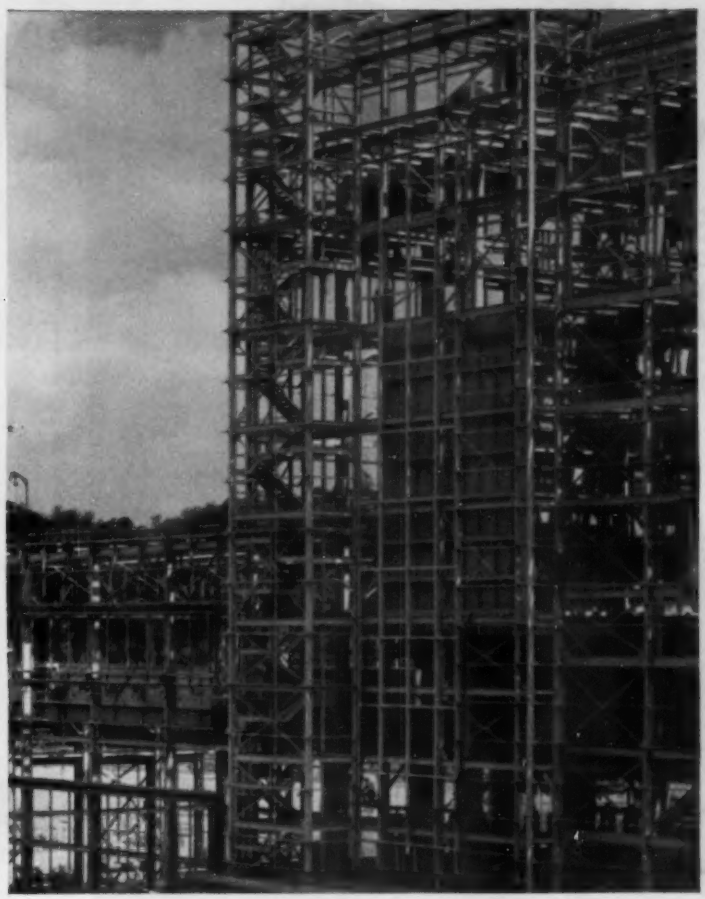
While Gorgas Steam Plant No. 3 is being built, American Blower constructs two Fly Ash Precipitators which will be installed in this new plant. Ratings: 340,000 cfm @ 285° F.

As in the past, Alabama Power installs American Blower equipment—in building for the future

WITH six steam and six hydroelectric plants, the Alabama Power Company forges ahead for the future of Alabama. In 1955 alone, it will invest more than $35,000,000 in bigger and better electrical facilities, including an eighth generating unit at their Gorgas Steam Plants. When completed this year, Alabama Power's capacity will be over 2,000,000 hp!

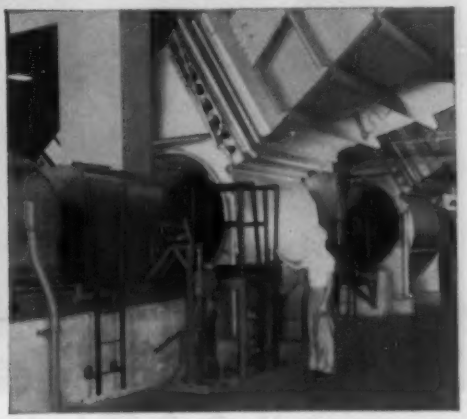
American Blower Forced and Induced Draft Fans, Fly Ash Precipitators and Gyrol Fluid Drives are being installed in this new plant.

From coast to coast you'll find American Blower playing an important role in the expansion and modernization of many other progressive, investor-



No. 8 generating unit, rated at 208,000 hp.

Gorgas Unit No. 7 uses American Blower Fans with Gyrol Fluid Drives. Induced Draft Fans (above) are rated @ 262,500 cfm @ 270° F @ 15.25" sp @ 569 rpm.



American Blower Forced Draft Fans on Unit No. 7 at Alabama Power's Gorgas Steam Plant are capable of 180,000 cfm @ 140° F @ 11.00" sp @ 868 rpm.

over 2,000,000 hp!

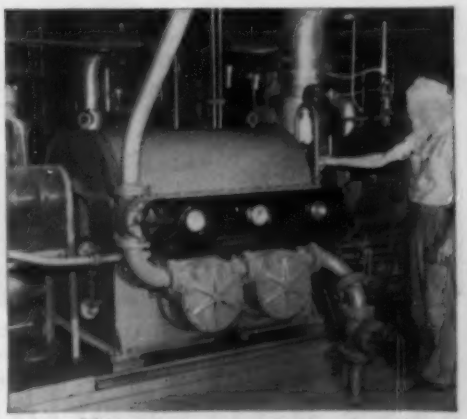
owned utilities. Plant operators have come to rely on American Blower Heavy-Duty Steam Coils and Fly Ash Precipitators, as well as our Mechanical Draft Fans, Dust Collectors, and Gyrol Fluid Drives for boiler-feed pump and fan control.

Give us a call to discuss *your* program. An experienced representative will gladly go over your requirements, and recommend equipment of the highest efficiency and economy. Contact your American Blower or Canadian Sirocco Branch Office.

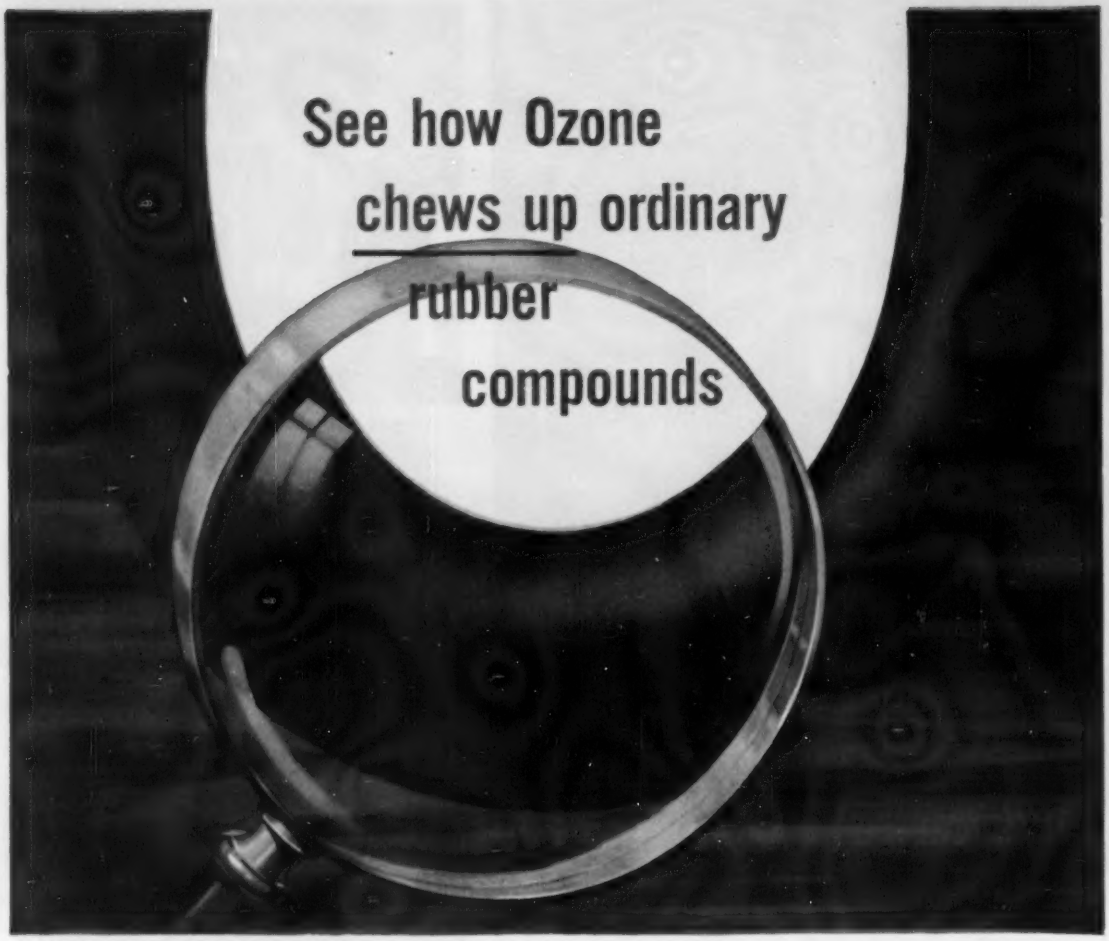
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

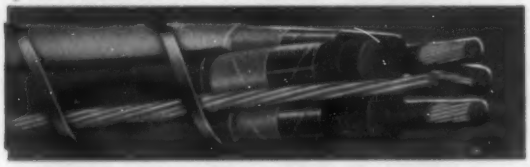


In addition to fan control, American Blower Gyrol Fluid Drives — class VI, 1500 hp — are used for adjustable speed control of boiler-feed pumps.



but not U. S. Grizzly Uskorona-insulated power cables

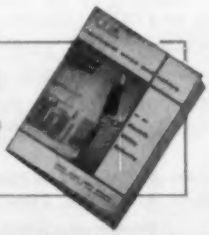
Here's an illustration showing how ozone can chew up a sturdy, rugged cable. This can never happen with United States Rubber Company's famous Grizzly® power cables, insulated with Uskorona® compound which prevents electrical failure caused by ozone (Uskorona-1 oil base compound and Uskorona-2 butyl base compound). Uskorona meets (and in many ways exceeds) the applicable IPCEA specifications for ozone-resistant rubber insulation.



U.S. Grizzly Uskorona-insulated Power Cable, 15,000 volts, Type RR, 3 conductor, shielded, Neoprene jacket

U.S. Grizzly ozone-resistant power cables are typical of the wires and cables "U.S." develops to meet the ever-increasing rate of expansion of electrical generation and construction. "U.S." is always ready with new products to meet new demands and is always developing, as a matter of policy, wires and cables that are more economical because they are more serviceable.

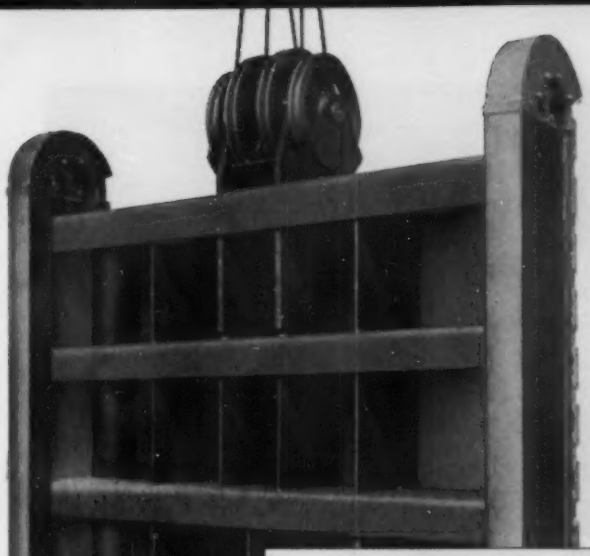
Send for free illustrated book giving full information about U.S. Electrical Wires and Cables for the Electric Utility Industry.



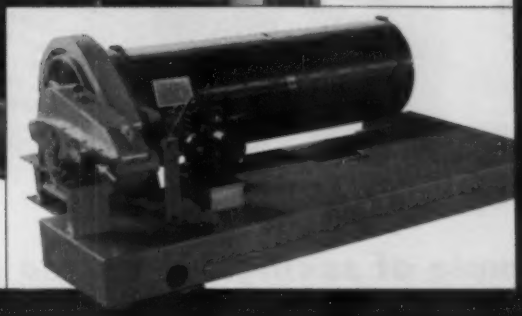
US RUBBER

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPARTMENT, ROCKEFELLER CENTER, NEW YORK 20, N. Y.



Roller Gate and Hoist for Pacific Gas & Electric Co.



HOIST... Hoist is engineered to raise and lower the intake gate illustrated. Its all-welded construction gives a clean, compact design. Minimum parts require alignment and maintenance. A 4.65 H.P. 450 RPM air cooled gas engine equipped with a battery starter provides economical power.

GATE... This 6'x7' roller gate, operated by the hoist picture, is an outstanding example of Paceco's low cost, rugged welded design. Note the few pieces used in construction. Strength is built in where required; extra weight and inefficient connecting members are eliminated. Continued satisfactory operation is exemplified by gate sheave construction; hoist ropes cannot leave the sheave grooves when seating the gate against the frame sill.

PACECO... In addition to gate and hoists, Paceco designs and builds cranes of all types and high-pressure gates and valves—all tailored to most economically serve your exact needs. Such equipment has been built and delivered at competitive prices, nationwide and internationally.

Your inquiry is requested for preliminary discussion or invitation to bid.

PACIFIC COAST ENGINEERING COMPANY

ENGINEERS • MACHINISTS • FABRICATORS

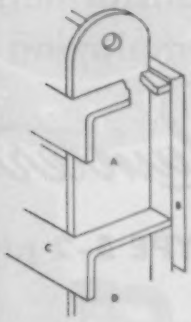
Alameda, California, Lakehurst 2-6100
3018 E. Foothill Blvd., Pasadena 8, Calif., RYan 1-9373

PACIFIC COAST ENGINEERING COMPANY, INC.
51 E. 42nd St., New York 17

PACECO
"TAILORS OF STEEL"®

IMPORTANT DETAILS

Conventional Design



PACECO Design

Compare the conventional with Paceco design! Paceco design provides lower cost, higher strength. There are fewer pieces to fabricate and less welding required.

Note these features:

A Sheave support plate is carried in one piece down to second stiffener. No welds in tension.

B Heavier skin plate allows wider spacing for stiffeners.

C Paceco simplified design permits wide engineering flexibility with reference to relative size of flange and leg. This, in turn, utilizes metal efficiently, resulting in less waste, lower weight and more economical cost of construction.

D Wide spaced diaphragm plates.

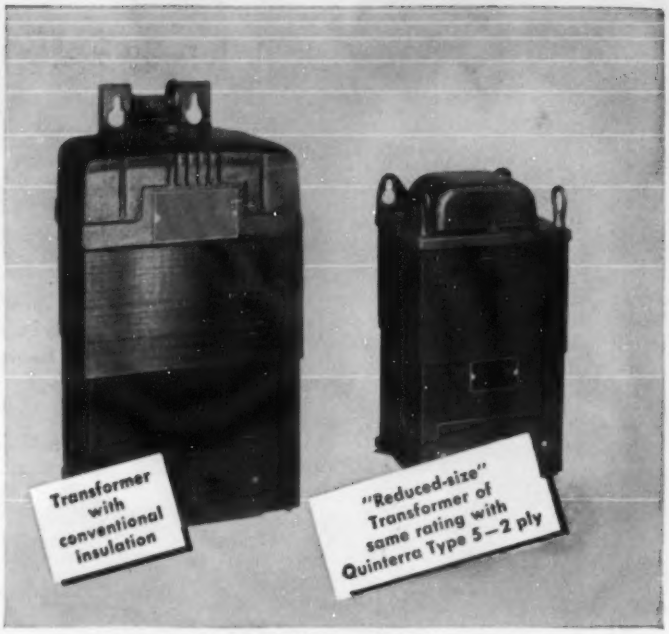
Send for Paceco's illustrated brochure, "Custom Designed Equipment for Hydro-Electric and Steam Power Plants and Water Works"

Weight reductions average 30%

in new line of transformers employing

*Quinterra**

TYPE 5-2 ply



Another example of savings permitted by this Johns-Manville purified asbestos insulation

A NEW LINE of dry type transformers announced by a prominent electrical manufacturer achieves savings in weight up to 50% in some models... 30% on the average. Contributing to these savings is the use of Quinterra Type 5—2 ply as layer insulation between the high and low voltage windings.†

Other manufacturers also report that Quinterra Type 5—2 ply permits substantial material savings. In addition, they state that this flexible insulation raises overload limits, increases safety, minimizes rejects, lengthens equipment service life, and lowers production costs.

Quinterra Type 5—2 ply possesses high thermal stability and lasting dielectric strength. It is a twin-ply, polyvinyl acetate treated purified asbestos insulation with a dielectric strength of 300 VPM. Even when its saturant is baked out by continuous exposure to 200 C, it retains the inherent dielectric of the base sheet which is at least 200 VPM . . . and it remains a dielectric up to 400 C.

Type 5—2 ply is the strongest Quinterra because it is made by combining and calendering two layers together into a dense, smooth surfaced insulation. Its good tensile and bursting strengths enable operators to achieve favorable production rates. Further economies result from its large square-foot-per-dollar coverage.

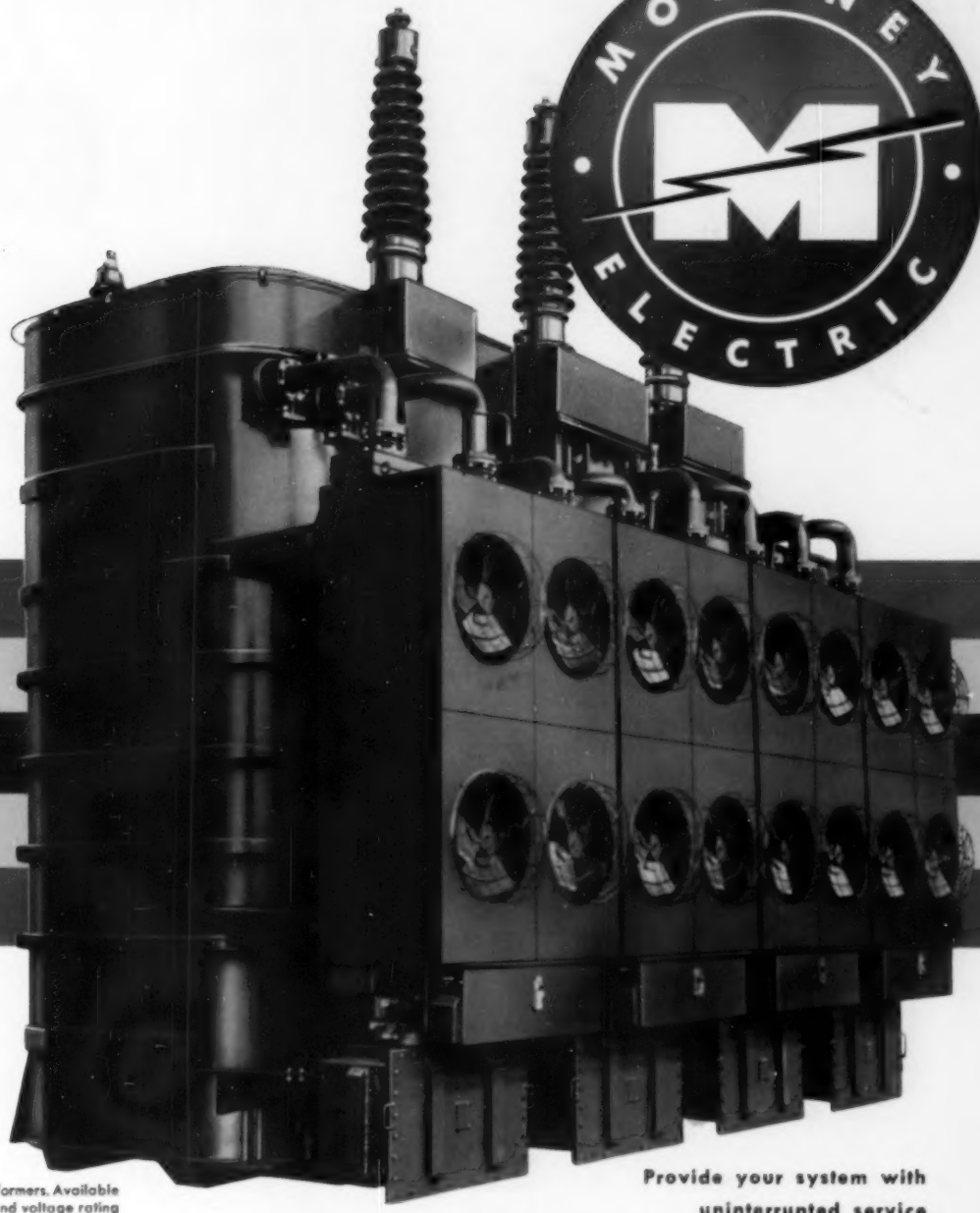
If you are a manufacturer of magnetic or resistance devices, Quinterra Type 5—2 ply may enable you to obtain substantial cost reductions. For samples and Quinterra Booklet EL-40A, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, address 565 Lakeshore Road East, Port Credit, Ontario.

†Quinorgobord #1100, another J-M purified asbestos insulation, is also used as end filler strips.
*Quinterra is the registered trade mark of Johns-Manville's purified asbestos electrical insulation.

JOHNS MANVILLE JM PRODUCTS

Johns-Manville ELECTRICAL INSULATIONS

Bulletin No. G-55



Power Transformers. Available in any Kva and voltage rating in both standard and special designs for utility and industrial application.

Provide your system with uninterrupted service

ALL ALONG THE LINE

Specify Moloney Transformers . . .
"Dependability at its Best"

MOLONEY ELECTRIC COMPANY

SALES OFFICES IN ALL PRINCIPAL CITIES

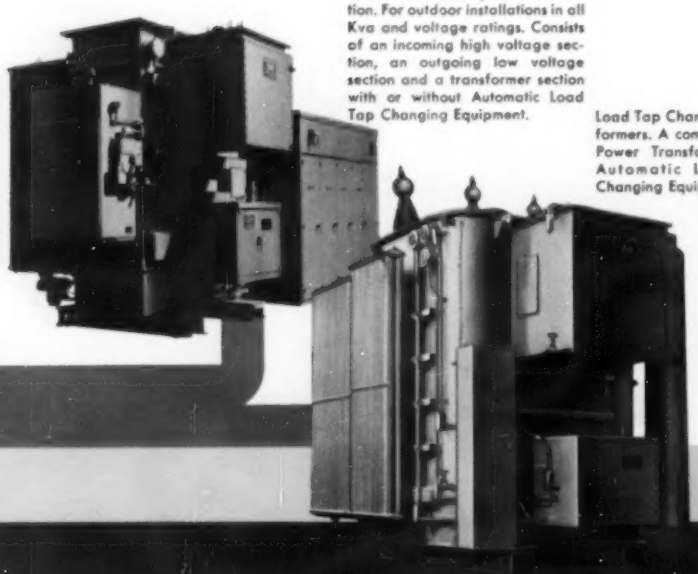
FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

From generating station, through transmission and distribution line, to the point of consumption . . .

ALL ALONG THE LINE

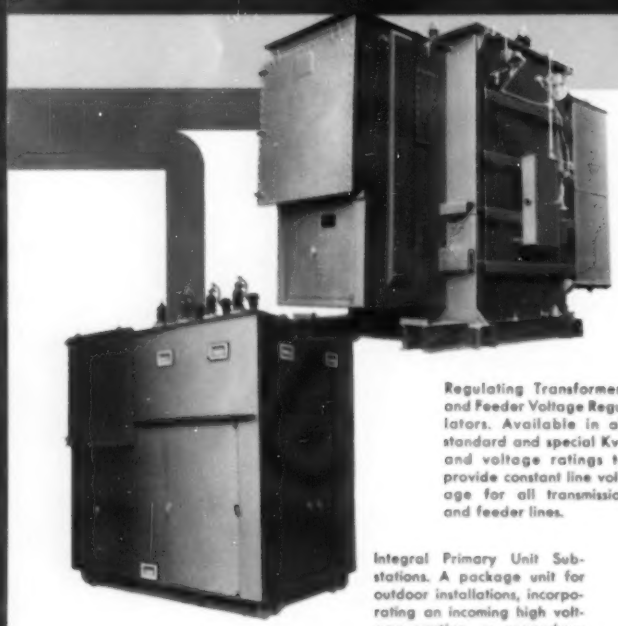
Moloney offers a complete range of transformers and regulating equipment. From the largest power transformer to the smallest distribution transformer, Moloney Electric combines their vast engineering experience with the most modern manufacturing facilities to produce the finest transformers obtainable.

Articulated Primary Unit Substation. For outdoor installations in all Kva and voltage ratings. Consists of an incoming high voltage section, an outgoing low voltage section and a transformer section with or without Automatic Load Tap Changing Equipment.



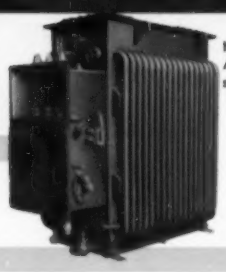
Load Tap Changing Transformers. A combination of Power Transformers and Automatic Load Tap Changing Equipment.

Large Distribution Transformers. For substation application. Available in all standard Kva and voltage ratings.



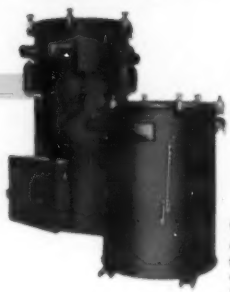
Regulating Transformers and Feeder Voltage Regulators. Available in all standard and special Kva and voltage ratings to provide constant line voltage for all transmission and feeder lines.

Integral Primary Unit Substations. A package unit for outdoor installations, incorporating an incoming high voltage section, a secondary circuit breaker and a Power Transformer with Automatic Load Tap Changing Equipment.



Network Transformers. Available in EEI-NEMA standard or special ratings.

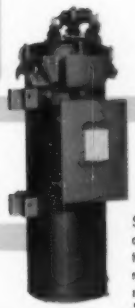
Subway Transformers. For locations where protection against submersion is required. Available in standard and special ratings.



Constant current Transformers. Available in standard and special ratings in both Conventional and Packaged Unit Types.

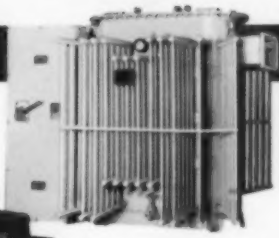
. . . . THIS SAME ENGINEERING AND MANUFACTURING KNOW-HOW IN

Capacitors. Available in standard Kvar ratings for primary voltage power factor correction.



Single-Phase Pole-Type Feeder Voltage Regulators. Self-contained and completely automatic to provide plus or minus 10% voltage regulation in 32—⅝% steps.

HiperCore Conventional and CSP Distribution Transformers. Available in all standard ratings.



Oil and Askarel-Immersed Load Center Transformers for Secondary Unit Substations. Available in Kva and voltage ratings to meet your specifications.

Type DWH Dry-Type Transformers 1½ through 15 Kva, 600 volts and below.

Type DWH Dry-Type Transformers 25 through 50 Kva, 600 volts and below.

Ventilated Dry-Type Load Center Transformers (Group 2 Insulation). For Secondary Unit Substations. Available in Kva and voltage ratings to your specifications for indoor installations.

Nitrogen-Sealed Dry-Type Load Center Transformers (Group 3 Insulated) for Secondary Unit Substations. Available in Kva and voltage ratings to meet your specifications for indoor and outdoor installation.

Type DV8 Dry-Type Transformers 25 through 50 Kva, 600 volts and below.

MOLONEY ELECTRIC COMPANY

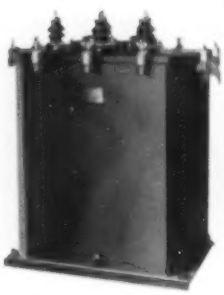
SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

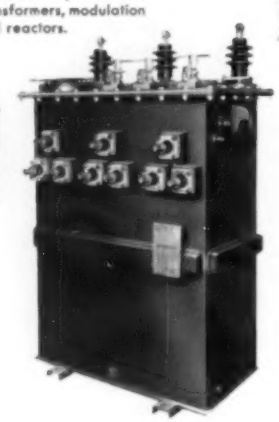
MAGNETIC COMPONENTS FOR ELECTRONICS

Electronic applications demand characteristics in components which can be provided only in combination with engineering experience and adequate manufacturing facilities. Because of this, quality electronic manufacturers specify Moloney Components.

Electronic Cores. HiperCore Wound Cores for smaller, lighter low-loss electronic transformers.

Magnetic Components for Transmitters, radar equipment, induction heating, precipitation and other special applications. Complete power supplies, rectifier transformers, filter reactors, filament transformers, modulation transformers and reactors.





MOLONEY ELECTRIC

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers • Industrial Dry Type Transformers • Capacitors • Magnetic Components for Electronics

LITHO IN U. S. A.

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

EDITORIALS

Hurricane Plans Get Tests

Electric utilities along the eastern seaboard could chalk up a "well done" for their performance in the wake of Hurricanes Connie and Diane. In all but the most severely damaged flood areas electrical service was quickly restored following the storms.

For the most part utility plans for rehabilitating damaged systems proved their worth in these first two tests of the season. Major electric companies hit by Connie's high winds had most customers back on the line within 24 hours after the hurricane passed. They were able to sound an "all clear" in a combined press release sent out to all wire services.

The ravaging floods caused by Diane spread more lasting damage as substations, generating plants, and even headquarters buildings were inundated. In these situations utilities moved quickly.

Metropolitan Edison Co for instance shifted its Easton, Pa., offices to higher ground when waters flowed into the first floor. To restore service to hard hit Stroudsburg, Pa., Metropolitian Ed's repair crews rolled in a portable substation and rebuilt a mile of distribution line in a single day.

For the most part utilities relied on their individual resources to combat storm damage. In only one or two instances was the mutual aid roster called into play to obtain outside repair crews. But the roster was useful in other ways. Participants used it to gain and exchange flood intelligence. Some used the roster to get emergency equipment from neighboring utilities.

The flood damage wrought by Diane was far different from the wind damage of Connie. Differences in the damage patterns may call for more comprehensive disaster plans to provide station equipment as well as lines equipment and manpower.

Experience gained in the first two hurricanes will be studied to iron out rough spots in rehabilitation plans. In the long run these studies will bring improved utility practices to reduce damage from wind and flood.

A $3.1-Million Gamble

Washington Water Power Co is known in the industry for its boldness and its ability to win on a long shot bet. It tackled and completed the difficult Cabinet Gorge dam well within a tight time schedule. It has managed to hold its own in many a political battle. WWP Pres Kinsey Robinson snatched the company out of public power hands after contracts and bonds had reportedly been printed and signed. This meant fighting his own boss, the late Howard Aller, who was all for selling the property to publicly owned utilities.

In recent years the company has expanded and prospered, but it hasn't grown soft. The boldness and the daring are still there. Just recently the company offered to put its $3.1 million worth of properties in Stevens County on the voters' table for a winner-take-all gamble with the Public Utility District in that county. Here is another long shot bet, for the odds are against WWP.

Here is the set up: The question will be put before Stevens County voters in the form of a resolution to dissolve the PUD. To carry, at least 3/5 or 60% of the voters must vote "yes." Any vote less than 60% means that the PUD stays in operation and will acquire the WWP properties in the county. This means that WWP is gambling on getting 60% "yes" votes in order to stay in business in Stevens County.

Because this is the first election of this type in Washington State, it may well gain national notice in private-public power debates between now and November when the votes are counted.

For those who want to place side bets, there are two things to remember. One, the starting odds are against WWP. Two, WWP has an unusual knack for coming up with the right combinations for winning when the dice are thrown.

Electric House Heating May Pay

Electric house heating could have a key spot in your scheme for improving annual load factor. Whether your initial reaction is a loud "yes" or a vigorous "no", you will want to read the article, 'Heating Can Be An Off-Peak Load," beginning on page 88.

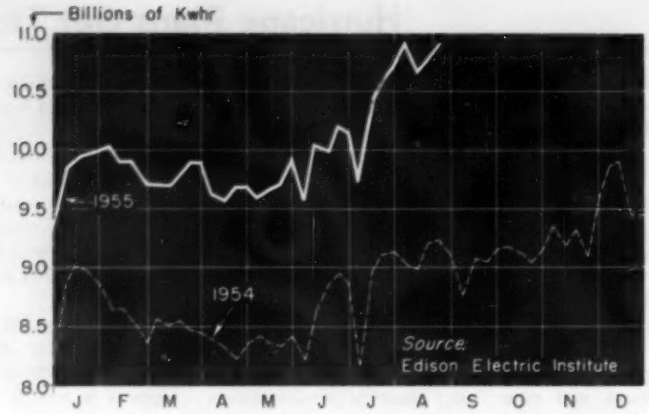
The authors set out to prove that electric house heating can replace other heating sources to the advantage and satisfaction of the customer and to the profit of the power supplier. This has been disputed ever since electric house heating was first suggested.

Based on a study of seven installations the article offers preliminary evidence that:

- Voltage of an electric house heating system can be reduced from 240 to 120 v during peak hours without complaint from customers.
- Most of the time when temperature is 30°F or higher, 120-v house heating is satisfactory.
- Customers find electric house heating comfortable and do not complain about costs (though none are given).

Admittedly the test sample is small. Much more information is needed to reach any final judgment. But the idea is a challenge both to those who support and those who oppose electric house heating. They can test more installations under more varied conditions. In this way we can get a sounder judgment of the study conducted by three Illinois cooperatives.

ELECTRICAL WEEK



OUTPUT

Week Ended Aug.27
10,906,000,000 Kwhr
Up 18.2%

Atomic Energy Commission requirements — 965,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 12.9%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Aug. 27	+18.2	+5.8	+12.8	+28.1	+11.7	+21.6	+12.8	+15.6	+17.2	+12.0
Aug. 20	+17.4	+6.5	+17.1	+30.3	+9.6	+22.7	−1.5	+8.7	+13.1	+13.1
Aug. 13	+19.3	+9.9	+15.2	+33.6	+12.4	+23.4	+8.4	+6.0	+13.7	+13.2

Seasonally Adjusted Index 205.7 Week Ago 204.2 Year Ago 174.4

News Highlights: Northeastern utilities repair severe flood damage . . . Georgia Power and Interior Department agree on plan to wheel Clark Hill power to north Georgia co-ops . . . Dallas P&L is planning its distribution system to handle triple 1954 loads . . . Studies are underway to determine the cause of excessive lightning outages on EHV lines . . . New ideas dominate design of Milliken Station of New York State E&G . . . Co-op study shows electric house heating can be off-peak load.

Preference customers scrap as hearings open . . . Spokesmen for municipalities charged that "super" rural electric co-ops are treated "preference, preference customers" in the purchase of federal power at first-day hearings before Rep Earl Chudoff's (D-Pa.) subcommittee on public works and resources in Springfield, Mo., Aug. 30. The House Government Operations Committee unit heard testimony of representatives of Oklahoma and Missouri "preference customers"—municipalities, rural electric cooperatives, and other public groups. The claim was made that additional government power was refused and syphoned off to private power companies or "super co-ops" for re-sale. Springfield hearings were being continued as EW went to press. The House group has scheduled hearings as follows: Atlanta, Sept. 2; Denver, Sept. 7; Idaho Falls, Sept. 8; and San Francisco, Sept. 12-14.

GE's awards to electric utilities for sales and services of greatest benefit to major appliance industry, October 1954 through June 1955, have been announced. For companies who retail, award goes to Kansas P&L; for non-retailers, to Washington Water Power. Honorable mentions went to: Retailers, Wisconsin Public Service and Ohio Power; non-retailers, Dallas P&L, Southwestern Public Service, Idaho Power, Electric Power Board of Chattanooga, Appalachian Electric Power, Detroit Edison, Florida P&L, and Union Electric of Missouri.

More discord among Nebraska power agencies . . . Continued lack of agreement over who should build new generating facilities was evidenced by Nebraska public power agencies' representatives after recent conference with Gov V. E. Anderson, who warned further inaction might result in a power brownout. Governor suggested he might name a citizens' committee of three to five members to arbitrate the squabble. After listening for more than an hour to power district officials express their views, the Governor said: "I don't believe we've come to anything concrete I can tell the people to assure them a power brownout will be avoided. You've been working on this problem two years. Something should have been done to start a power generating plant a year ago, two years ago. We must have a solution."

NEWS OF THE INDUSTRY BRIEFLY TOLD

Off the Washington Wire: While commercial or industrial builders of atomic reactors will have to pay full costs of materials and services rendered them by AEC, the agency plans to continue furnishing fuel material and heavy water—and related services—without cost to non-profit medical and educational institutions.

Coal and copper prices up . . . Soft coal prices moved up about 30¢ a ton on the average to reflect miners' $1.20 daily pay boost. For the first time this century the national average price of bituminous coal will pass the $5-a-ton mark. FPC has reported electric utility consumption of coal in June was over 11 million tons. This will mean a monthly increase of around $3 million in the industry's coal costs. And copper prices, upped the second time in eight days, took their fourth jump of the year, posting a 3¢ advance to 43¢ a lb.

Interior Secretary Douglas McKay said he will not run for the Senate against Sen Wayne Morse (D-Ore.) because of age. McKay said that at 62 he is "too old" and that he has never lost in eight public elections.

OVEC construction schedule ahead . . . Ohio Valley Electric Corp has passed half-way mark when sixth (215,000 kw) of 11 steam units was put into operation last week. Unit is the third at Kyger Creek Plant on the Ohio River near Gallipolis, Ohio.

Bangor-Hydro-Electric gets rate hike . . . Maine PUC has granted Bangor Hydro-Electric an estimated $275,000 a year rate increase, 4.9% above present revenues.

From the West Coast Wire: Two proposals for sites for the $95-million Yellowtail Project's dam and reservoir will be offered to Bureau of Reclamation by Crow Indian Council on Sept. 7. First is a $5-million "fair market value" of the site if the council decides to sell. Other provides for a 60-year lease at $150,000 a year, with property returning to the tribe at end of period . . . Pacific G&E has built its 14th plant of the ten post-war years. The $25-million, 84,000-kw station on Pit River was dedicated on Aug. 26.

Cordele, Ga., gets 99-year power lease. City of Cordele representatives have approved a 99-year lease agreement with Crisp County Power Commission to get electric power for the city's present and future needs. Lease becomes effective Jan. 1, 1956.

ABOUT PEOPLE IN THE INDUSTRY

Borrowers still purchase about 85% of the power they distribute, REA Administrator Ancher Nelsen says in annual report just released. It comes "either from electric companies or from public agencies, but they generate the other 15%, and there continues to be cases where borrower-owned generation facilities are needed. It is usually advantageous to integrate or interconnect REA-financed facilities with those of other power suppliers. In most situations that turns out to be the approach that assures dependability of service and lowest cost."

Itself badly hit by the recent northeastern flash floods, Pennsylvania P&L has been quick to come forward with generous aid for flood sufferers. Announcing a contribution of $50,000 from the company to the Red Cross, Pres Charles E. Oakes said: "Pennsylvania P&L considers itself a citizen of the communities it serves. Such citizenship provides the opportunity to make this needed contribution beyond the normal obligation of maintaining and restoring electric service."

More News About People page 160

FLOOD WATERS surge into Worcester County Electric Co's plant, Webster Square, Worcester, Mass. Photograph taken after rains stopped

RIVER CRASHES OVER BRIDGE, PUTNAM, CONN.

Utilities Repair

Catastrophe Recorded

Creeks and rivers, swollen out of bounds by torrential rains in the wake of the season's fourth hurricane (EW, Aug. 29, p 8), had subsided last week, and the Northeastern utilities in areas struck by flash floods began the urgent task of repairing, salvaging, and rebuilding.

At least 150,000 customers had been knocked out of service, generating plants were flooded, substations wrecked, and poles and lines destroyed. Utility damage mounted into the millions of dollars.

From the hardest hit regions in Pennsylvania, Connecticut, and Massachusetts came pictures recording the force and extent of the floods which had struck with little warn-

BUILDING AFLOAT is Metropolitan Edison Co's Dock Street Plant, Easton, Pa., after Lehigh and Delaware Rivers leaped their banks

SALVAGE WORK AT MECO'S LAFAYETTE SUBSTATION

Flood Damage

by Camera in 3 States

ing and of work done to salvage plant and repair damage.

Counting up the destruction along the western side of the lower Delaware River, Philadelphia Electric Co reported that its damage totaled $110,000. Two substations and 30 poles had been washed out, and lines were knocked down at about 1,400 locations. Service to 29,000 customers had been affected, but all except 800 were back on the line before the flood waters had receded.

Westinghouse Electric Corp reported its plants and repair shops throughout the Northeast had gone into emergency operation to handle repairs on manufacturing and utility equipment damaged in the floods.

EMERGENCY LIGHTS FOR SOUTHBRIDGE, MASS.

MECO EVACUATES employees from Easton, Pa., office where flood waters later rose 4½ ft above first floor of building (see editorial, p 59)

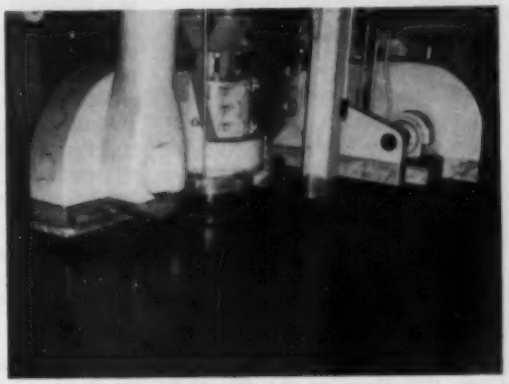
Flood Damage

(*Continued from page 63*)

LINES ARE REPAIRED AT TORRINGTON, CONN., WHERE DOWNTOWN AREA WAS SHATTERED BY FLOOD

REPAIRMEN SWING ON CABLE TO REACH DAMAGED MECO AREAS ACROSS BUSHKILL CREEK, PA.

PHILADELPHIA ELECTRIC CO SANDBAGS FOR FLOOD AND MECO RESTORES SERVICE WITH MOBILE UNIT



WATER SPRAYS AS HOUSATONIC PS CO PUMPS OUT DERBY PLANT WHERE PULVERIZERS WERE FLOODED

WORKMEN SAVE bushings from rising flood waters at MECO's Easton, Pa., storehouse; water subsequently rose three ft in one hour, stopped salvage operations

Wheeling Plan for Clark Hill Aired

The Interior Department and the Georgia Power Co, a private utility, reached agreement on plans for wheeling electricity from Clark Hill Dam on the South Carolina-Georgia border to a group of north Georgia Rural Electric Co-operatives.

The co-ops have not agreed to it; at mid-week, they had not even been given draft copies of the proposed agreement. But on principle they had won their fight to retain status as preferential customers of government-produced electricity and, as such, to buy it directly from the government.

Interior Rules Out Former Plan

What the Interior Department did was to back away from a proposal to sell the energy to Georgia Power which, in turn, would have re-sold it to the co-ops at government specified rates.

Georgia co-ops objected to this and cited the Flood Control Act of 1944 in defending their position. That law establishes public bodies, municipalities, co-ops, and so forth as preferential customers for such power.

Army Corps of Engineers built the Clark Hill Dam on the Savannah River, between Georgia and South Carolina, primarily as a flood control reservoir. But it produces hydro-electric power, rated at 280,000 kw, for equal division between the two states.

South Carolina's public bodies have been taking its 140,000 kw without dispute, because transmission from the dam's bus bar was no major problem. The South Carolina Public Service Authority has transmission lines at the dam for wheeling the power to preferential customers.

Dilemma Arose Under Democrats

On the Georgia side, no such public wheeling facilities existed. The transmission lines there belonged to Georgia Power which balked at wheeling power to co-ops which have always been direct customers of company.

The dilemma first arose during the Democratic Administration. Democratic Interior Secretary Oscar Chapman handed it down, unresolved, to the Republicans two years ago.

Rural Electric Cooperatives from coast-to-coast howled a year ago—and the Georgia co-ops walked out on negotiations — when the Republicans proposed to invoke the "sound business practice" section of the Flood Control Act and to sell the power to the private utility. Fitful negotiation has been in progress ever since.

The co-op cause, it appears probable, got a lift from the Justice Department. Reports cropped up several places in Washington this week that Justice lawyers had told Interior that its earlier proposition would violate the preferential clause of the 1944 act.

Co-ops saw the Clark Hill dispute as a precedent-setter, a chipping-away of their statutory right to get public power. They also maintained that, as private utility customers, their future growth potentials would be killed.

Harllee Branch, President of Georgia Power Co, says the proposed settlement will give the co-ops no benefits that would not have been available to them under the earlier proposition. The co-ops, Branch says, will get the same quantities of power at the same prices.

Georgia Power, he says, would have been willing to re-sell the power to the co-ops at no profit, taking for itself only a service fee for handling and to cover line losses.

The utility contends also that the co-ops do not need all the Clark Hill energy at all times, but only at peak periods — mornings and evenings. Georgia Power, on the other hand, says it could make more efficient use of it by spreading it out through its system at all times.

Branch Approved Earlier Proposal

Under the earlier plan, which also received Branch's approval last year, Georgia Power would have reimbursed the government for Clark Hill power

Branch Scores New Proposal

Harllee Branch, president of Georgia Power Co, last week issued a statement giving his views on the new proposal for wheeling Clark Hill Power to the co-operatives. His remarks as made to Electrical World were as follows:

"It will be interesting to see whether those who have so noisily demanded a wheeling contract will now accept it or whether they will seek to further prolong the controversy to political and selfish purposes. Our understanding with the Department of Interior is that the tri-party contract which we previously negotiated and which was signed by our company in May 1954, still remains available to the co-ops if they desire as a group to accept it. Either the tri-party proposal or the modified wheeling proposal—but not the two in combination—will be applied to the sale of Clark Hill power in Georgia.

"We have not withdrawn our offer and don't intend to do so. If it is finally rejected, then its critics must account to the farmers who are served by the co-ops and the other preference customers as well as to the taxpayers for turning down a proposal that would have delivered Clark Hill power to them more cheaply and more efficiently and over a wider area than any other method yet devised, even including the modified wheeling agreement now announced by Interior.

"There is no benefit available under the new agreement which was not available under our proposal. The preference customers will get the same amount of power and pay the same price for it under either plan (because the government will make up the difference.)

"The difference is the government, under the wheeling agreement, will engage in the business of supplying power to co-ops and other preference customers who have heretofore purchased power requirements from our company at rates among the lowest in the nation.

"This entry by the government into the power business in Georgia has seemed to us neither necessary nor desirable. It will cost vast sums which would not be required under our non-profit, tri-party contract proposal. The promoters of government subsidized power will have to explain this wasteful and unnecessary expenditure to the already heavily burdened taxpayers."

at the rate of $9 per kw year of capacity and at the rate of 3.4 mills per kwhr of energy. The company would have delivered the power at the same rate per kw year of capacity and at four mills per kwhr of energy. The specific average power cost to preference customers would have been 6.28 mills per kwhr, at 45% load factor. Rates would have been guaranteed by the government.

By terms of this tri-contract proposal, Georgia Power would have acquired title to the government power and would have sold it, in turn, to the co-ops. Under the proposal now being considered, the utility, without acquiring title to the power, will merely wheel to the co-ops which would purchase the power direct from the government.

Prolonged Dispute Predicted

"It will be interesting to see whether those who have so noisily demanded a wheeling contract will now accept it," Branch says. He foresees a possibility they will "seek to further prolong" the dispute for "personal and political" purposes.

On the other side, Marshall Pollock, President of the Georgia Electric Membership Corp, a statewide co-op organization, says, "We are very pleased that Interior has decided to sell us the power from Clark Hill. We feel that future negotiations can be entered into."

Only proposed settlement term spelled out by mid-week was this: Georgia Power's wheeling contract with Southeastern Power Administration, which administers Clark Hill affairs, would call for delivery of 350 million kwhr annually at the switch or 315 million kwhr at the customer's substation.

Three Contracts Involved

The affected co-ops, during the battle, have been taking all their supply from Georgia Power. An Interior spokesman says they will still have to obtain supplemental power from the private utility. Thus, if the settlement is finally obtained, it will be a three-contract package.

One will be between Georgia Power and the Southeastern Power Administration, covering the wheeling service. The second will be a seller-buyer pact between the Government and the co-ops. The third will cover Georgia Power's supplemental power deliveries to the co-ops.

Foreign Bid Moratorium . . .

. . . on selective basis is being considered for federal projects after low British bids on Chief Joseph Dam equipment rejected

The Administration's "Buy-American" policy, which was liberalized last year to give foreign bidders a better shot at U. S. government contracts, shifted in the other direction last week. Two developments underlined the shift:

- Defense Department, after months of deliberation, awarded $6.9-million worth of contracts for power equipment for the Chief Joseph Dam to Westinghouse Electric Corp and Pennsylvania Transformer Corp—despite the fact that Britain's English Electric Export & Trading Co, Ltd, was low bidder.
- Behind this news lay a policy struggle which has been going on since the beginning of the Eisenhower Administration. The buy-American law of 1933 requires the government to purchase from domestic suppliers unless their prices are unreasonable. In the past a domestic bid was considered unreasonable if it exceeded a foreign bid by 25% or more.

Buy-American Eased Last Year

Eisenhower last year narrowed this preferential margin to from 6 to 10%. English Electric's bid on the Chief Joseph equipment was more than 10% lower than the lowest domestic bid.

However, the order permitted agency chiefs to invoke buy-American rules regardless of price if doing so would relieve unemployment, aid small business, or promote the national interest.

Secretary of Defense Charles Wilson took advantage of the unemployment loophole to throw Chief Joseph contracts to American companies.

Secretary Weeks's proposal is related directly to the foreign reaction to the Chief Joseph decision. Weeks's idea is that it should be possible to determine in advance whether a contract is going to be awarded to an American bidder on permissible grounds such as unemployment. Then foreign bids on such projects would not be requested. Thus foreign firms would be saved expense of preparing bids and the U. S. government would be spared embarrassment of refusing a low foreign bid.

Defense Chief Charles E. Wilson directed Army Secretary Wilber M. Brucker to reject the British bids in favor of the domestic firms.

Unemployment a Factor

Both contractors have promised to produce the electrical equipment in the Pittsburgh area, certified by Labor Secretary James Mitchell as suffering "substantial unemployment" with 6% or more of the available labor force out of work.

"Substantial unemployment" was stipulated as a basis for exceptions in the President's executive order defining buy-American standards for government procurement last December. And it enabled the Defense Secretary to pass over foreign low bids which in all other respects met the Eisenhower requirements.

Announcement of the contract awards to domestic firms at prices higher than English Electric Export & Trading Co, Ltd, had stirred up a storm of criticism on both sides of the Atlantic. Wilson's decision was derided as a direct slap at the liberalized buy-American policy which Eisenhower put in effect last December. Britain's Foreign Office expressed "grave concern."

Barrage within Administration

Within the Administration, the barrage gave rise to reports that some earnest Republicans want to bar foreign bids entirely on the government's domestic procurement.

Eisenhower's position on reciprocal trade is too well known to admit the thought that he might exercise his discretionary powers to exclude foreign bids completely.

It was not the first time equipment contracts for Chief Joseph Dam had made trouble for federal officials. In early 1953, the Corps of Engineers got a shock when English Electric put in low bids totaling about $6.25 million for two generators and ten transformers. No foreign bids had been expected.

Wilson rejected those tenders and called for new bids based on revised specifications. The contracts went to Westinghouse for the two generators and to English Electric for the ten transformers.

Utility Finds Suggestion Plans Need

MANAGEMENT
Industrial Relations

Florida P&L's program enjoys 30 years of successful operation, has never used suggestion box and offers only modest rewards

LOWIS CARLTON, Advertising Department, Florida Power & Light Co, Miami, Fla.

Next year, the suggestion plan at Florida Power & Light Co rounds out 30 years of continuous operation, and it is more active than ever. Company officials believe this to be the best record of any utility in the Southeastern area.

Yet the suggestion plan offers modest cash awards, maintains no suggestion boxes, operates at a minimum expense. Secret of this success story is management's determination to keep the system fair and square, combined with support from executives and a good publicity program.

A meter reader in Miami had this to say about the FP&L plan which keeps ideas of suggesters a closely guarded secret. "We don't hesitate to say what we think. Our supervisor passes on ideas concerning this department, but the final okay comes from officials higher up."

With a grin, he concluded, "It's a good feeling, knowing that the top man hears what you have to say."

ED STANLEY, right, suggested this automatic microfilming device which cut record filing space from 250 to 2 cu ft

Employees send in suggestions covering every phase of the fast-growing utility's statewide operation. Occasionally, someone asks that the water cooler be moved nearer his desk or a hopeful youngster nominates himself for a raise. But most suggestions reflect serious thought. The acceptance rate shows this. Last year, one out of four was the average number adopted.

The suggestion plan is set up to operate in the personnel department and Personnel Director Robert W. Wall, Jr, also acts as suggestion committee chairman.

Anonymity Strictly Preserved

To preserve strictly the anonymity of suggesters, committee secretary Virginia Hollenich maintains locked files. Even committee members cannot obtain names without special approval from a top executive. Researching and special investigations are handled by Otto Bentz. This staff of two divides its time between the suggestion system and the personnel department.

FP&L immediately gives a $5 award when an idea is adopted. This qualifies the suggestion for entry in the semi-annual "contest" and prizes from $5 to $50. Additional cash is given when suggestions show unusual merit.

Suggestions, submitted in triplicate, come through company mail. The one signed copy goes into locked files. An unsigned copy, identified by number only, is mailed to supervisors, managers, and department heads.

Suggestions Thanked Personally

Final judge is the executive in charge of the operation which the suggestion concerns. An accepted suggestion goes to the person charged with putting it into effect. After this, a $5 award is sent to the employee.

The committee observes a few iron-clad rules. Speedy acknowledgement of all suggestions is a "must." A personal letter thanks each suggester for sending in the idea, whether accepted or not. If not, he is given the reasons why. The result: Suggestions are frequently revised, resubmitted, and adopted.

Original ideas are protected by the committee for one year, may be resubmitted then for another year's protection. When requested, the company advises employees how to file for a patent.

Importance of Publicity

Semi-annual winners are chosen by a nine-man committee—a gas department executive, five vice presidents, superintendent of distribution and transmission, and the manager of power supply.

Monthly winners' names are announced, but suggestions are not identified until after the major awards are made. This insures impartial judging throughout. Rejected suggestions remain permanently anonymous.

Stimulated interest is vital to any suggestion plan. FP&L does it with letters and literature mailed to employees' homes and with regular news stories in the monthly house organ.

No Big Awards

Also effective are colorful booklets, pamphlets, bulletin board posters, and, best of all, encouragement from supervisors direct to employees. An engineering question may be answered by a supervisor or an idea given for a sketch. Having a suggestion typed for any employee requesting it is standard practice.

Suggestions Count in Promotions

It is well known among FP&L personnel that the company views suggestions as indicators of an employee's interest in his company and takes them into consideration when promotions are made.

As an example, a man who started as laborer reached the supervisory ranks two years ago. In between were years of steady progress and an equally steady record of suggestions submitted. Here was a man displaying active powers of observation and a sincere desire to do a better job.

He is a good supervisor, and the ideas which once went to the committee now are put into practice on the job to save time and work and step up efficiency.

Annual Cost Modest

Cost is not excessive in the FP&L suggestion system. Employees get recognition and publicity for good ideas, and this helps the system grow. In 1951, 405 suggestions were received. In 1954, there were 822. Prizes awarded totaled $3,090 for 618 awards in the last four and a half years, with another $3,190 given in major awards and in a special contest.

To this expense must be added the time of supervisory personnel who read and evaluate suggestions. But company executives state that the system pays its way, building benefits which far outweigh the cost.

Program Generates Goodwill

"The good will produced by a successful suggestion plan is almost impossible to measure. At the very least it improves relations in the industrial family," said Wall.

"Take a man who has complained, 'If I were boss, I'd do this thing another way.' He doesn't have to complain. He can suggest a new and better way. When he sees his idea put into practice, he feels he is needed and has a part in the actual running of the company. Instead of a disgruntled employee, you have a cooperative team member."

Yet the committee has problems. The old question of whether supervisors could compete for awards was solved by making them eligible, providing the suggestion did not pertain to work under their authority.

Minor crises occur when an idea is adopted which was considered by management before the suggestion was received, when several people get the same idea at the same time, when conditions change and a rejected suggestion is put into effect.

FP&L takes the problem direct to the employee. On a printed sheet enlivened by cartoons, it explains the situation in simple language and invites the employee to contact the committee if he has further questions. Hundreds do each year.

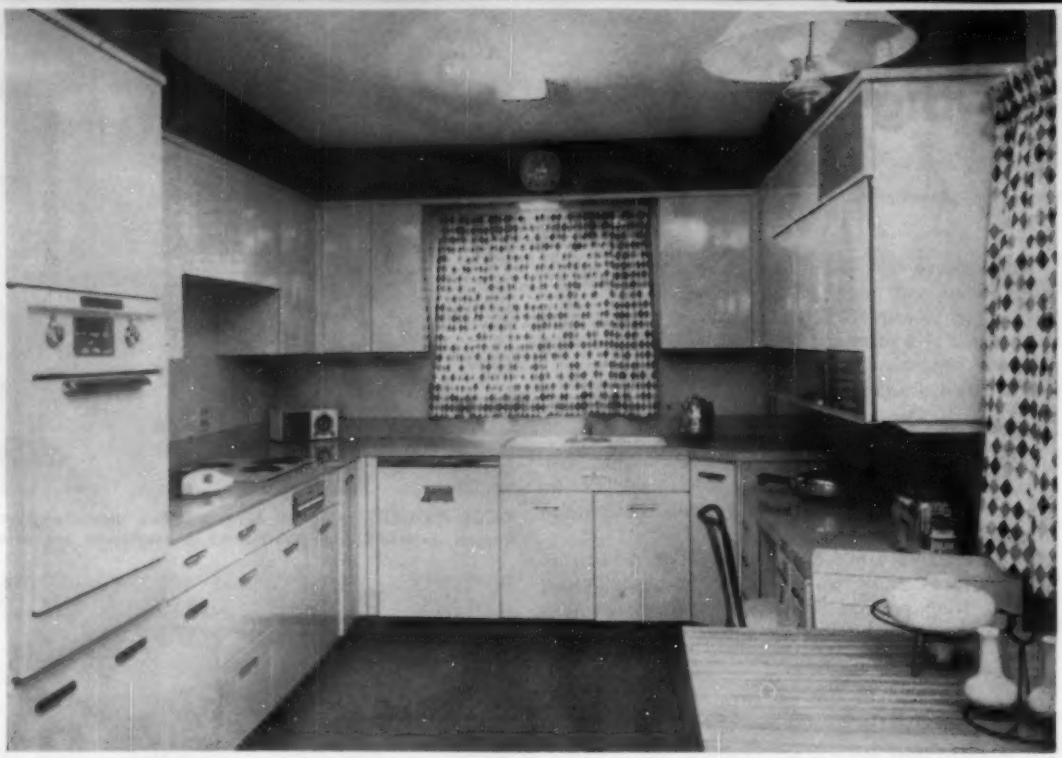
Under pressure of heavy work or rush jobs, a supervisor may delay studying suggestions. A follow-up system maintained by Secretary Hollenich helps keep suggestions moving, prevents long delays.

"We like to remember that the entire electric industry was built on an idea by a man named Edison," says Wall. "We are sold on the importance of ideas; so naturally we are sold on our suggestion system. It makes every desk, every line truck, every sales territory an observation post for the 'better way'!"

FP&L, growing rapidly with a $410 million expansion program well under way, is serving one of the nation's most rapidly developing areas. The company lays great stress on finding the safest, best, quickest, and cheapest way to accomplish the most work and to improve service.

GOOD PUBLICITY is one of keys to FP&L's successful plan. Posters, booklets, and direct mail to employees are used

C. W. OVERFELT collected double the usual top $50 semi-annual prize award for this device to ground oil fuse cutouts



LESS OBVIOUS FEATURES OF KITCHEN INCLUDE WALL REFRIGERATOR, RIGHT; SINK; GARBAGE DISPOSER; DISH WASHER

LIGHTING PRODUCES DRAMATIC EFFECTS IN LIVING ROOM

AUTOMATIC DRYER AND WASHER ARE IN UTILITY ROOM

All-Electric Home for Farm Draws . . .

SALES
Residential

. . . favorable reaction from farmers in Kansas P&L's area

The first General Electric Co "wonder farm" home is providing a big attraction for Kansas farmers. Co-sponsored by Kansas Power & Light Co, it attracted 20,000 visitors the first three weeks and as many as 600 people an hour the first day it was opened.

Heavy advertising artillery was concentrated on the opening of the home. Press and employee previews preceded the formal opening. A 30-minute TV preview whetted the public's appetite to see the house. This was supplemented by radio, newspaper stories, and ads.

Features of the home include:

- Heat pump for summer and winter air conditioning.
- Remote control wiring.
- All-electric kitchen with built-in units.
- Light conditioning.
- Water system with 100-ft well and submersible pump.
- Automatic washer and dryer.

The refrigerator-freezer unit is the new wall cabinet type. All appliances are colored, petal pink in the kitchen and canary yellow in the laundry room.

Lighting was tailored for specific needs and for decorative effects. Dramatic results were obtained with fluorescent lights recessed in the living room mantel and with spotlights in the dining room.

Building Distribution for Future Loads

DISTRIBUTION
Design

Dallas P&L Co plans system for triple 1954 load level. Proper location and type of substation are basis of expansion program

J. P. BARRON, Engineer, and
G. W. HENDERSON, Engineer, Dallas Power & Light Co, Dallas, Texas

Two factors, one economic and the other physical, have developed in recent years to focus increased attention on planning of the distribution system. On the economic side has been the problem of offsetting such unfavorable trends as declining load factor and increasing costs of construction and operation. On the physical side the problem has been one of keeping pace with the rapid growth of load which has been felt so greatly in the Southwest because of the widespread acceptance of residential air conditioning.

Growth experience of Dallas Power & Light Co during the past decade has not been greatly different from that of other Southwestern companies. During this period the company's load increased 351,400 kw. In the five years, 1948 to 1953, the annual rate of growth has been about 17%, a growth of 113% for the five-year period. In 1954 the growth was about 17½%, and at the present time there is no evidence of a leveling off in the growth.

To provide adequate facilities to

(*Continued on next page*)

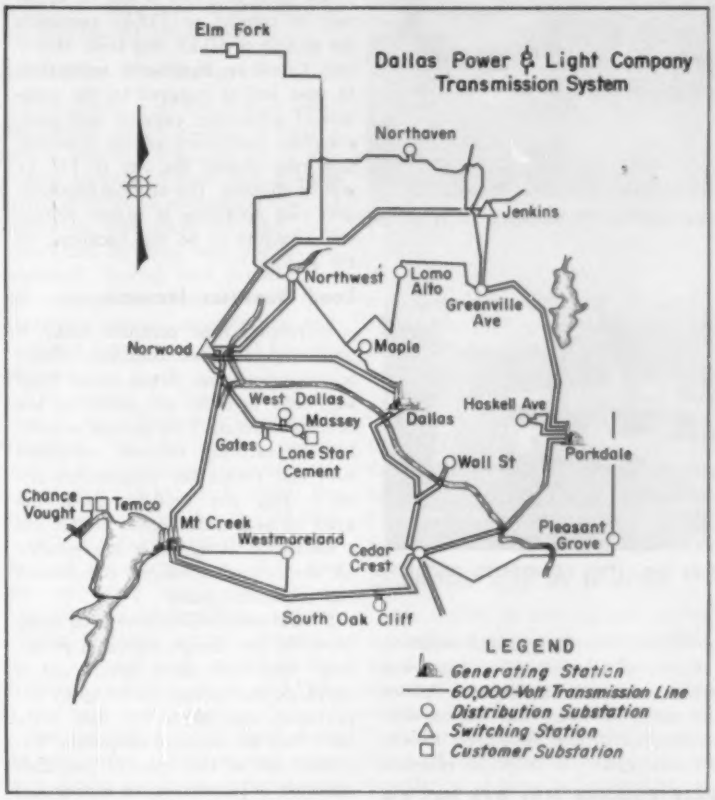


FIG 1—TRANSMISSION LOOP AROUND THE CITY OF DALLAS IS RATED 60 KV

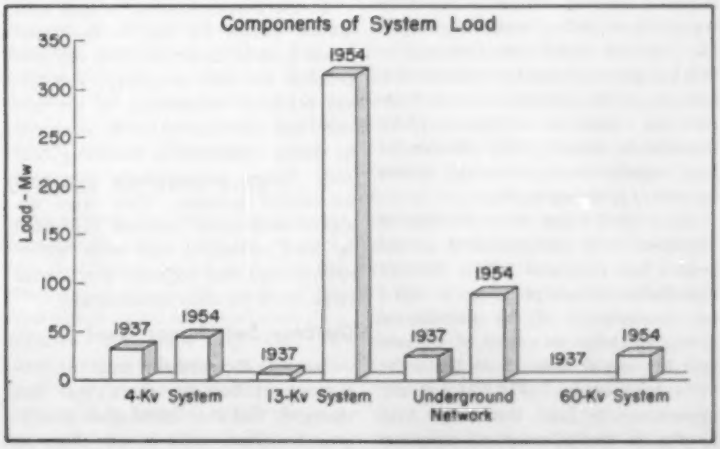


FIG 2—LOAD ON DALLAS POWER & LIGHT SYSTEM HAS SOARED SINCE 1937

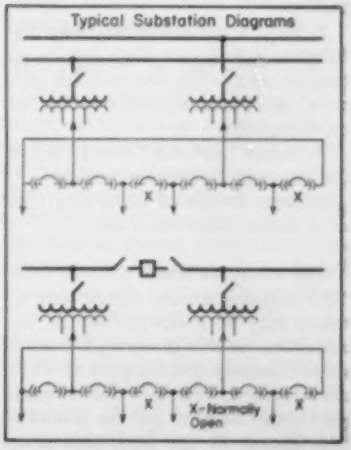


FIG 3—SUBSTATIONS ON 60-KV LOOP

LINES OF THIS DESIGN SERVE SUBSTATIONS IN THE CITY'S CONGESTED DISTRICTS

serve this growing load Dallas Power & Light Co has had a transmission-distribution plan since 1930. Because of the depression of the early thirties, the plan was not put into effect until 1937 when initial steps were taken to:

1. Decentralize and reinforce the bulk-supply facilities by construction of a 60-kv transmission ring around Dallas.
2. Build a number of 60/13-kv distribution substations along this transmission ring, each designed for ultimate development to 40,000 kva or more capacity.
3. Adopt 7,620/13,200 v (13 kv) as the standard distribution voltage.
4. Begin the use of shunt capacitors as a major distribution tool.

The extent to which each of these 1937 planning objectives has been attained may be observed from an examination of the company's present system, the principal elements of which are shown in Fig 1. This diagram shows the location on the transmission system of the three generating stations with an aggregate capacity of 482,000 kw, the principal switching stations, distribution substations, and major customer substations. All of the early 60/13-kv distribution substations have been developed to 40,000-kva capacity as originally planned.

Peak Demand Hits 475,200 Kw

During 1954 the peak demand of the system reached 475,200 kw. Of this total load 89,000 kw were served from two secondary networks, 45,000 kw from the radial 4-kv system, 25,000 kw directly from the transmission system, and the remainder, some 316,000 kw, from the overhead 13-kv distribution system. This division of load, together with comparable values for 1937, is shown in Fig 2.

Since 1937 when these distribution objectives were adopted, load on the system has increased 640%. Present distribution-system planning is based on development of the distribution system in Dallas to a level of 1.5 million kw—more than three times the 1954 load level of 475,200 kw and approximately four times the load level at the time of the plan's adoption.

In development of the transmission-distribution plan for the 1.5-million-kw level, all of the basic concepts of the original 1937 plan have been retained. However, it has been found necessary to raise the sights in several respects.

With the installation of a 115,000-kw generating unit at Mountain Creek plant in 1956, it will be necessary to convert to 138-kv operation the section of 60-kv ring from Mountain Creek to Northwest substation. In time and as required by the addition of generating capacity and load, complete conversion of the transmission ring around the city to 138 kv will be effected. The original transmission ring operating at higher voltage will continue to be the backbone of the system.

Load Densities Increase

Increasing load densities make it necessary to install additional distribution substations. Areas where these high load densities are occurring are developed areas. They present a problem of securing suitable substation sites and routes for tranmission circuits. This has brought about the need for both a 60-kv line design and a substation design that are suitable for use in such developed commercial and residential areas.

Several installations have been made using the line design shown in photo. Such lines, built along streets and in alleys, do not present an unsightly appearance, and up to this time there have been no customer objections. Extensive use of this type of line construction is planned as an economical and practical solution to the problem of serving new substations in developed areas.

In the development of a new substation design for use in developed areas, a basic departure from our past practice has been necessary. The earlier 60/13-kv substations of the system were constructed on the same site as major transmission switching centers. Space requirements presented no special problem. They were designed with open buswork supported by steel structures and with widely spaced bays and required a relatively large areas for their construction.

Outdoor Switchgear Used

But with the need for installing substations in built-up areas, that has changed. Outdoor metal-clad switchgear has been used in an effort to develop a compact substation of sub-

stantial size and pleasing appearance, for application in these areas. Our first installation of this type was made at Lomo Alto substation, where two 20,000/33,000-kva tap-changing-under-load transformers were installed. To make these stations acceptable in almost any location, equipment has been painted and sites have been landscaped to make them as attractive as the surrounding neighborhood.

Substation Size Adopted

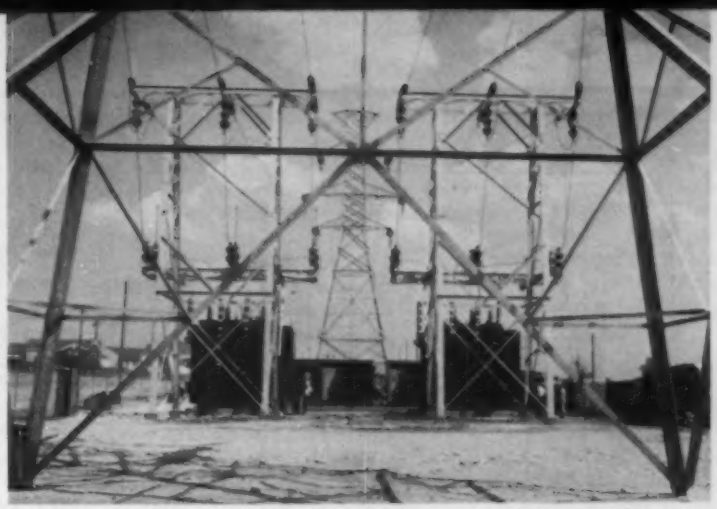
Concurrent with the transmission-distribution study looking toward a system load of 1.5 million kw, a substantial amount of work was done to arrive at the most economical size and design of substation for the company's load densities, both present and predicted. Taking into consideration the existing load densities and their expected increase, a substation with an initial capacity of 25,000 kva was adopted.

This station is unique in several respects. Fig 3 shows typical substation diagrams. The basic station includes four 13-kv feeders with a normal capacity of 6,250 kva each (7,500 kva maximum) supplied by two 12,000/16,000/20,000-kva tap-changing-under-load transformers. A 13-kv ring bus employing circuit breakers of 250,000 kva interrupting capacity permits prompt service restoration should any unit of the station be lost. Primary switching at 60 kv or 138 kv is kept to a minimum.

The upper diagram of Fig 3 shows the application of this station design to a double-circuit transmission supply. The lower diagram shows its application to a single supply line with a sectionalizing primary breaker. With bus regulation and with switched capacitors on the distribution feeders, adequate control of voltage during normal operation is obtained. During the outage of a transmission line or of one of the two transformers, operable voltage can be maintained.

Designed for ROW Strip

As most of the company's principal transmission ring is installed on right-of-way which is owned in fee by the company, a design was made of this type of substation for installation on a 100-foot right-of-way strip. This ability to install a substation on the transmission right-of-way permits present stations to be installed where they are required for present loads with assurance that locations for additional intermediate substations will be available when they are needed. Such a substation constructed on transmission right-of-way is shown in photo.



SPACE IS CONSERVED BY CONSTRUCTING SUBSTATIONS ON RIGHTS-OF-WAY

Also, the design of the basic substation can be expanded to an eight-feeder, 50,000-kva station by replacing the 12,000/16,000/20,000-kva transformers with 25,000/33,000/41,000-kva transformers and adding cubicles for four additional feeders.

Capacities May Be Doubled

Because of the compactness of this substation arrangement and its flexibility to meet changing load requirements, it has been adopted as a basic building block for development of our distribution system over a wide range of load densities. Plans call for installation of these substations as indicated by a long-range plan. For locations of present average load density, the installations are being made at twice the separation which is contemplated ultimately. As load densities increase, intermediate stations will be installed. As the load densities increase further, the capacity of the substations will be doubled as needed.

With this arrangement of substations it appears that the distribution system can be expanded in an orderly manner to serve any level of load density which might reasonably be expected to develop.

With these principles and tools for the planning of the distribution system, it remains to determine the magnitude of expected loads and the timing of extensions necessary to serve such loads and yet not install any capacity before there is actual need for it.

To do this, the basic approach has been through our long-range plan for serving a load of three to four times that currently being experienced. The first step in preparation of the long-range plan is that of forecasting the future service area and the distribution of load within such service area.

Following study of all the factors involved, a plan is adopted as the basic long-range plan until the load reaches the half-way mark for which the plan was prepared. Then another similar long-range plan is prepared, looking ahead to approximately four times the load currently being experienced.

The present plan, based on serving a load of 1,500,000 kw, contemplates a new power plant, the operation of the transmission ring around the city at 138 kv, the installation of an additional supply for the underground networks, and the addition of approximately 1,250,000 kva in distribution substation capacity.

Plan Subject to Revision

While this plan is subject to continued study and to revision where necessary, it serves as an over-all guide for acquisition of transmission rights-of-way, spacing of distribution substations, timing of transmission and substation construction, establishment of substation service areas, and proper location of the principal distribution feeders within such substation areas. More importantly perhaps, it serves at all times to keep in proper perspective, before all interested persons, the magnitude of the problem of serving a future load of two, three, or four times the present system load.

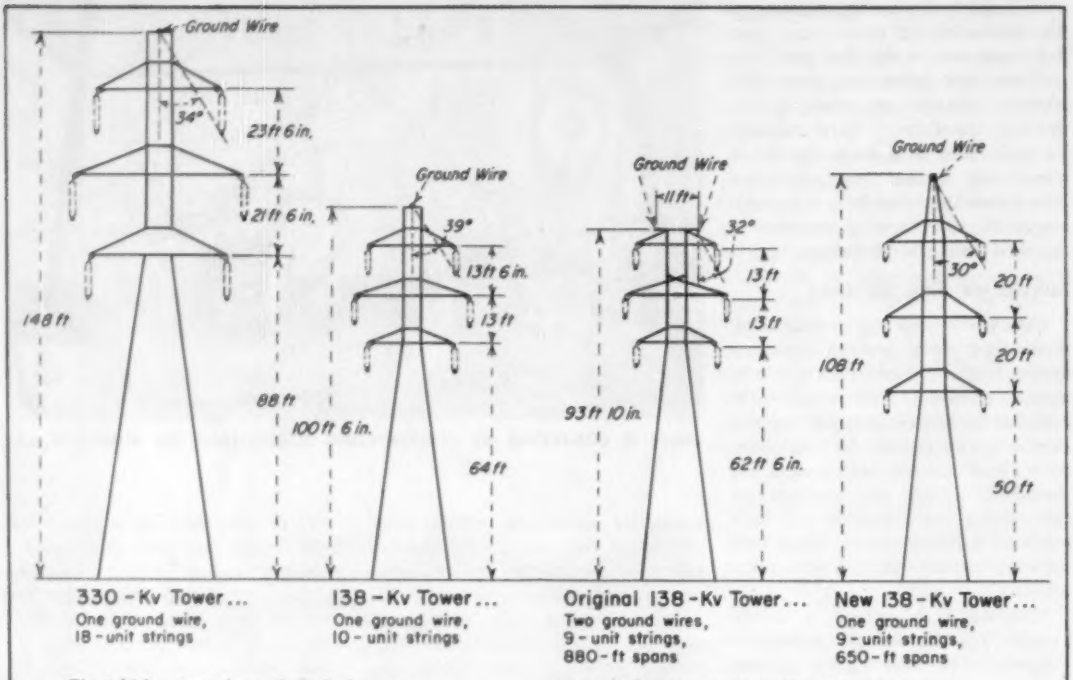


Fig 1 (A) - American G & E System

Fig 1 (B) - Commonwealth Edison Co.

Evaluation of New Tower Designs May Reveal . . .

Why EHV Lines Show Excess Outages

TRANSMISSION
Design

Lightning causes flashovers considerably in excess of the rate predicted from design data. Investigation reveals:

- **Burns on both upper and lower surfaces of suspension insulators removed from lines after flashover.**
- **Steep-front pulses in laboratory create similar markings.**
- **Test waves flash insulator strings shunted by tower leg.**

DR CHARLES J. MILLER, JR, Research Engineer, The Ohio Brass Co, Barberton, Ohio

Two power companies have experienced outages caused by lightning on extra-high-voltage tower lines far in excess of the rate predicted by usual methods. Studies seeking a satisfactory explanation are now underway.

Many of the outages resulted from flashovers of the top or the middle-phase insulator strings on towers with very low footing resistance. Examination of these insulators reveals glaze burns produced by lightning which indicate that the flashover paths hug both the upper and lower surfaces of each unit in the string. This characteristic suggests that the lightning voltage pulses which produce these glaze burns have very steep fronts.

Furthermore, glaze burns from the resulting power arc are generally found on both upper and lower surfaces of nearly every unit in the string. In a number of cases investigated, marks on the tower tops indicate where they were hit by lightning strokes.

Laboratory investigations show that when a steep front voltage pulse from a 3-million-v impulse generator is applied to a 22.5-ft section of 6-in. angle-iron tower leg, enough potential is produced to flash over a 3-unit string of suspension insulators connected in parallel with it. Glaze burns from these tests are very similar to those produced by natural lightning.

Photographic studies of flashovers produced in the laboratory with very steep front voltage pulses on various length insulator strings indicate strings could flash over in a fraction of a microsecond when subjected to suitably steep voltage pulses.

By use of traveling wave theory, it can be shown that when a lightning stroke hits the top of a tower, voltage at that point rises rapidly until reflected waves of opposite polarity return from the tower base and alleviate the

voltage build-up. Because time to crest is dependent upon travel time for voltage waves down and up the tower, an increase in tower height causes an increase in crest voltage for a given steepness of the front of the voltage pulse.

Crest Voltage High at Tower Top

Magnitude of this crest voltage may be several times as great as the ultimate tower-base voltage to which it decays within one microsecond as a result of multiple reflections between top and bottom of the tower. Thereafter the tower top voltage is practically equal to the tower base voltage which is determined by existing footing resistance in accordance with the usually accepted theory.

As a result of this investigation it would appear that the majority of flashovers in excess of those predicted by the usual method may be caused by these short duration high voltage pulses. They have been known for many years and apparently until now considered unimportant. However, the traveling wave theory does not disclose so great a difference in tower top voltage with tower height as would seem to be indicated by comparing operating records for lines with 100 and 150-foot towers. This field experience would seem to suggest that a more fundamental mathematical approach, perhaps based on Maxwell's equation and field theory, may be necessary for complete evaluation of the problem.

Recognition of the causes of these unexpected flashovers has resulted in a rekindling of interest in the flashover characteristics of line insulation in the region below two microseconds. It will undoubtedly lead to a reinvestigation of the design factors for EHV transmission lines.

High outage rates caused by lightning on several recently constructed transmission lines have led to a new investigation of the factors affecting the flashover of transmission line insulation.

Field Experience Discloses Problem

Operation of the initial sections of the American Gas & Electric Co's 330-kv system indicated a lightning flashover rate greatly exceeding that predicted by the usual method. Tower height on this system averages about 150 ft, and insulation consists of 18-unit strings of 10-in. diam suspension insulators.

A portion of this early experience was obtained on an Appalachian Electric Power Co 330-kv line operating at 138 kv. A certain 10-mile section of this line is located in a mountainous region of West Virginia where tower-footing resistances are relatively high compared with those elsewhere on the system. This section is roughly paralleled by a nearby 138-kv line which has generally similar footing resistances. The 330-kv line has 150-ft towers and 18-unit strings of suspension insulators while the 138-kv line has 100-ft towers and 10-unit strings.

The outage rate of the mountainous sections of both lines may be influenced to some extent by the higher level of footing resistances. But it is significant that the 330-kv line with 80% more insulation than the 138-kv line had a flashover rate comparable to the line designed for 138 kv. This observation would seem to indicate that tower height may be an important factor in outage frequency. Physical comparison of these two towers is shown in Fig 1 (A).

Experience in other sections of the 330-kv system, where all tower footing resistances are well under 10 ohms, indicates that flashovers are occurring at a much higher rate than predicted by the usual method despite low footing resistances.

Commonwealth Edison Co in Chicago recently added a 6-mile extension to an existing 138-kv system. Its operating record shows outages at a rate many times as great as the previous rate of about 2 per 100 miles per year which this company had experienced for its entire 138-kv system over a 27-year period. Principal features of the two types of construction compared are illustrated in Fig 1 (B).

Flashovers Confined to Top and Middle Strings

Both power companies report that part of the flashovers involve either one or both insulator strings on the top crossarm while the remainder occur on one or both strings on the middle crossarm. They also report that tower-footing resistances are generally under 10 ohms, except in mountainous regions, being as low as 1 or 2 ohms for several towers involved.

The usual method of estimating tower voltage is to multiply footing resistance by crest value of the lightning stroke current which flows in the tower. Unless this product gives a voltage which equals or exceeds the flashover voltage of the insulator string, there is usually no flashover. With the low tower-footing resistances involved, fantastically large lightning stroke currents on the order of one to two million amp would be necessary to produce tower potentials sufficiently to flash over the line insulation. Furthermore, experience has shown that under this condition the flashover would probably be on the bottom phase insulator strings.

The insulator strings shown in Fig 2 are but two of many strings examined in the field investigation. In addition to the power arc glaze burns, visible on the top surfaces of most of the units, many of the units also have power arc burns on their under surfaces.

Close examination of these units and of many more which have been involved in middle- or top-phase flashovers reveals rather narrow glaze burns. These burns were probably produced by the lightning stroke that triggered the power arc leading to the outage.

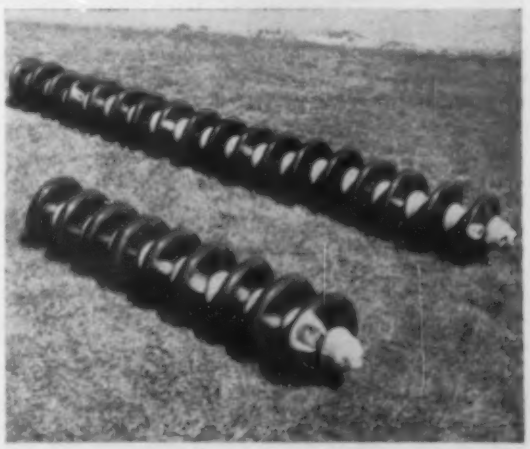


FIG 2—LIGHTNING BURNS MARK GLAZE of most units in 18-unit insulator string from AG&E 330-kv line and every unit in 10-unit string from Commonwealth Edison's 138 kv

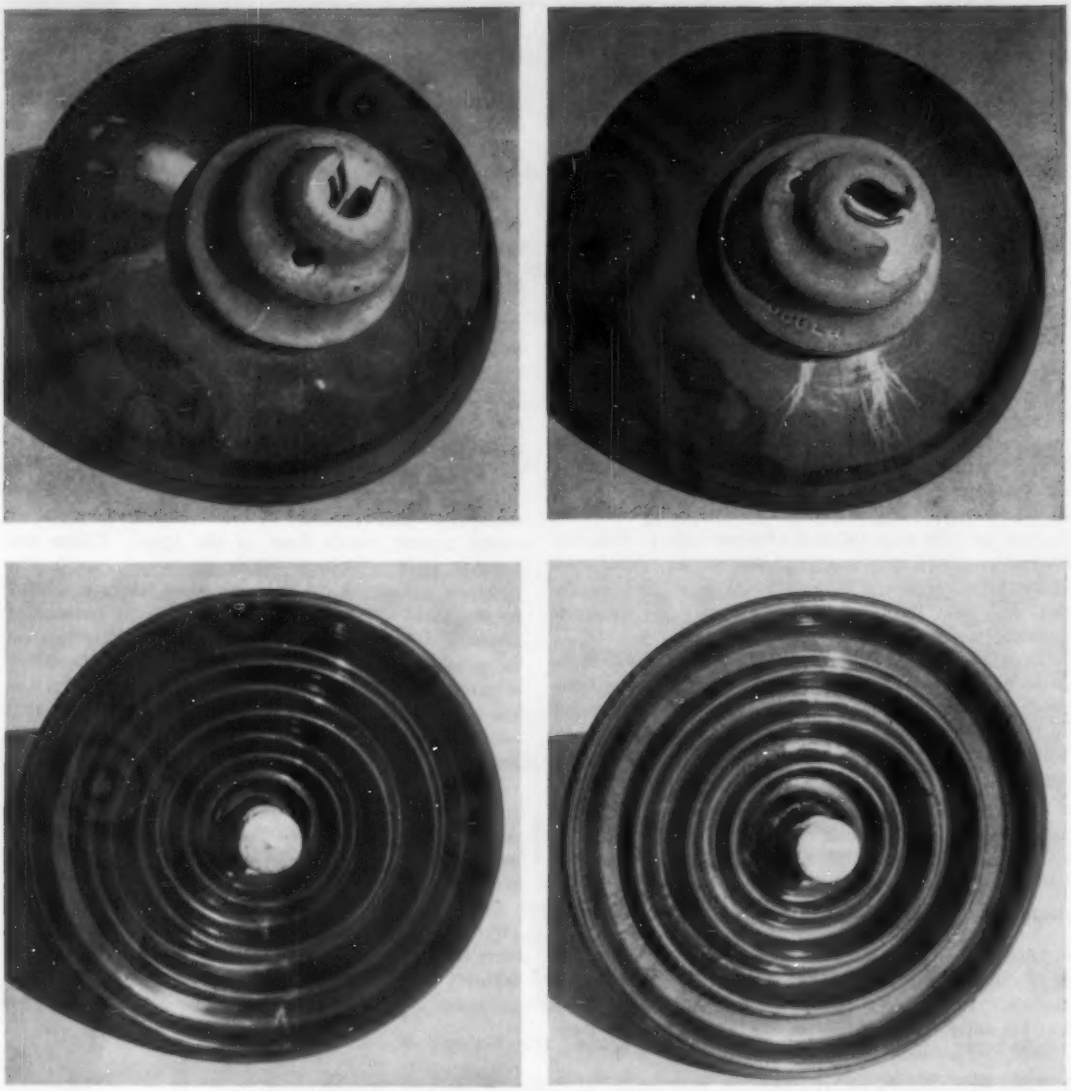


FIG 3—FLASHED-OVER INSULATORS FROM 330-KV LINE (left) show narrow burns on upper and lower surface from lightning stroke and wider 60-cycle burn. Similar burns are apparent in laboratory sample (right) flashed while shunted by 22.5-ft tower leg; multiplicity is attributed to repeated tests, and lesser magnitude to test equipment limitations

One insulator unit shown in Fig 3, which was near the center of a middle-phase, 18-unit string, reveals details of the narrow glaze burns caused by lightning and the much wider glaze burns produced by the resulting 60-cycle power arc. Other units in the same string had similar glaze burns of both kinds. Examination of the top of the tower from which this string was removed gave positive evidence that the tower had been hit by lightning. The footing resistance of this tower was 2.2 ohms.

In laboratory impulse testing, it is observed that at near critical flashover voltage the arc generally strikes clear of the string in a single long path from one end to the other. On the other hand, at high over-voltages the arc path strikes around each unit in the string individually. Based upon this laboratory experience, the presence of lightning-produced glaze burns on both surfaces of each unit in the string, even to the depths of the grooves between petticoats, strongly suggests that the initial flashover of each of these strings was caused by a very steep front voltage pulse. The presence of power-arc glaze burns on both surfaces of many units in the string supports this conclusion.

It seems quite likely that the first one or two half cycles of power arc would more or less follow the path of the initiating lightning stroke. Thereafter the arc would tend to sweep clear of the string.

Results of the field investigation lead to the hypothesis that these unpredicted top- and middle-phase flashovers may be caused by short-duration high-voltage pulses which apparently can occur across insulator strings when

the tower top is struck by lightning. The nature of the lightning-produced glaze burns indicates that these voltage pulses have very steep fronts. This, in turn, suggests that the insulators flash over in a very short interval of time, perhaps less than one microsecond. Existence of these short-duration high-voltage waves can be demonstrated by traveling wave theory.

Laboratory Tests Revealing

To supplement the field data, a series of laboratory investigations has been made in the High Voltage Laboratory of Ohio Brass Co, Barberton, Ohio. Many tests were made in which steep front voltage pulses from a 3-million-v impulse generator were applied to tower members of various lengths and configurations. One test of this series is shown in Fig 4. Glaze burns left on the middle unit of the 3-unit string by a number of flashovers are quite apparent in Fig 3 (right).

Photographic studies were made with strings of various lengths connected in parallel with a rod gap. With the impulse generator charged each time to the same voltage, the parallel rod gap was so adjusted that it chopped the pulse just barely below the flashover voltage of the insulator string. Photographs of the string taken in the dark show the progress towards flashover at the instant voltage is chopped. Analysis of these photographs shows that every unit in the string is practically at flashover. In many instances more than half of the units in the string appear to have flashover paths already completed.

These studies lead to the conjecture that each unit in the strings simultaneously builds up to flashover and that, if a long string of insulators were subjected to a sufficiently large steep-front voltage pulse, it could flash over in almost as short an interval of time as that required for one unit. Under such conditions the time to flash over would probably be much less than one microsecond. It is suggested that the expression "fractional micro second flashover" might be appropriate to describe these phenomena.

The laboratory demonstration that it is possible to flash over an insulator string in parallel with a steel tower leg when subjected to a very steep front voltage pulse and the conjecture that long strings of insulators may flash over in a fraction of a microsecond seems to furnish the evidence needed to complete the hypothesis which explains the unpredicted top and middle phase flashovers. These are now engaging the attention of company engineers.

Now Recognize This Factor in Old Data

There seems to be some evidence in techical literature that flashovers of this type are not new; they just have not been recognized for what they are. For example, the curve presented in Fig 5, which is Fig 25 in the AIEE 1941 Transactions paper by Wagner, McCann, and MacLane, shows the relation between "tower footing resistance in ohms" and "flashover per hundred line-miles per year." This curve is based on 2,426 mile-years of double-circuit 132-kv transmission lines.

The significant feature of this curve is that for zero tower footing resistance the outage rate is 12 per 100 miles per year. Although some of these zero resistance outages may be from shielding failure, as suggested by the authors, it would now seem more likely that a number of them may have been the phenomena described in this article.

FIG 4—LABORATORY TESTS PROVE VERY STEEP TEST WAVE will flash insulator string shunted by 22.5-ft tower leg

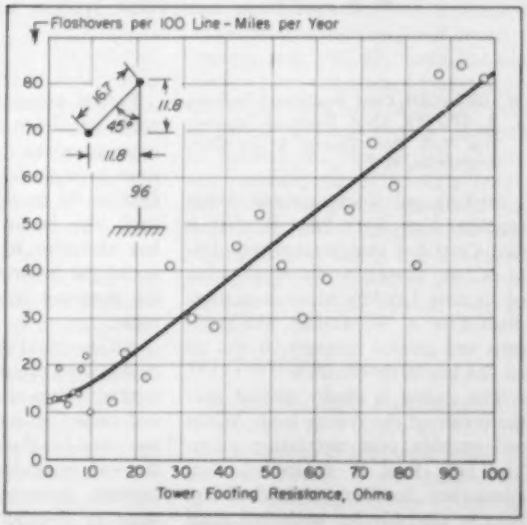
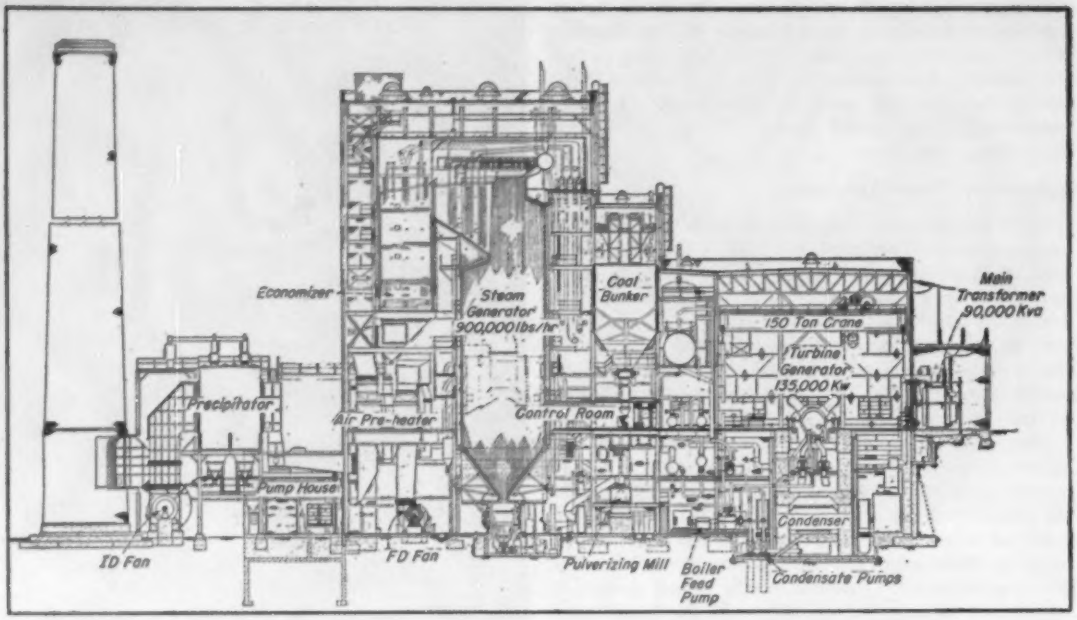


FIG 5—FLASHOVER RECORD OF 2,426 MILE-YEARS OF 132-KV reported to AIEE with this curve. Note rate at zero ohms



New Ideas Dominate Milliken Design

New York State Electric & Gas Corp newest plant will have:

- **Automatic coal handling system providing continuous flow of coal**
- **Ash handling system reusing bottom ash sluicing and conveying water**
- **Circulating water system without the use of traveling screens**
- **Demineralization for purification of the plant water supply**
- **Inner-cooling of both rotor and stator windings of the generator**
- **Preset base excitation system with separate automatic regulator**

W. GREACEN, Chief Mechanical Engineer, **J. R. STOVER**, Chief Electrical Engineer, New York State Electric & Gas Corp, Binghamton, N. Y.

Striking out from accepted design practice, New York State Electric & Gas Corp has incorporated new features (see above) in almost all areas of its new 135-Mw Milliken Station. Named for A. W. Milliken, vice president and general manager, it will go on the line early this fall.

The station is ideally located near the center of the system load. A lake will provide cold circulating water. The lake level is controlled, thus eliminating flood problems. Sufficient land is available for unlimited plant expansion. Area has adequate rail and highway facilities.

Future extensions will be to the north, parallel to the lake shore. Boiler room faces the lake, and the turbine room is on the land side of the station next to the transformers and switchyard. This layout was used as it was less expensive to pipe cooling water under the boiler room than to carry the generator bus through the boiler room.

All structural steel has shop-riveted, field-welded connections. This was less expensive than all-riveted construction and caused no erection trouble. Brick was used for the service building and the wall separating turbine and transformers. Remainder of building was done in Q-panel at a considerable saving.

Every effort has been made to eliminate disturbances. Noise levels have been kept low by locating the turbine and transformers on the land side of the station and by placing forced draft fans indoors. A car dumper was used instead of a car shakeout. Windows on the lake side were kept to a minimum, and outlets from the ventilating systems were arranged to prevent broadcasting over the lake. The 2,000-hp boiler feed pump motors are of a special low noise level design. Motor cooling fans and baffling have been rearranged in an attempt to depress the sound emission.

At peak boiler load, expected electrostatic precipitator efficiency will be 98%. This, with a 250-ft chimney, will reduce local fallout to an imperceptible amount.

Mechanical Details

The mechanical engineering department in collaboration with Gilbert Associates, Inc, consulting engineers, evolved a completely new coal handling system best described as "automatic continuous reclaim."

Coal will be unloaded by a car dumper into the track hopper. A 900-ton per hr belt conveyor will carry all coal to the outdoor storage area. Final section of this belt will be a boom which will permit virtually dustless build-up of a 70-ft coal pile over a 33-ft square reclaim hopper. About 5,100 tons of this pile will be considered active storage and can be reclaimed without the use of earth movers. Earth moving equipment will be employed to move coal to the inactive storage area.

No Tripper or Unloader

Reclaim hopper will be actually four 16-ft-square hoppers arranged in a tight square, each equipped with a variable-rate vibrating feeder of 300 tons per hr capacity.

Each pair of feeders will serve a 300 ton-per-hr high-speed crusher. These will produce a 1-in. ring size product. Both crushers can feed either of two 300 ton-per-hr conveyors running to staggered discharge points on a bunker; no tripper or unloader will be employed.

Enough Coal for 3 Days

The two belts are designed to be loaded 24 hours per day at rates equal to the station coal consumption and controlled by the vibrating feeders. Consequently a small bunker, only 700 ton capacity, was deemed adequate as it would be full at all times and would provide 14-hr operation at full load in the event of failure of both belts. Furthermore, because the active storage pile has a reclaim capacity of 5,100 tons, a total of 5,800 tons of coal will be available for use, an amount sufficient to carry a unit at full load over a three-day weekend.

Central Control

All controls for the reclaim portion of the coal system will be in the control room where they will be incorporated in a panel with the bunker level indicators. This will relieve the coal crew of operating responsibility for this equipment. Because of this equipment, a four-man crew on a 40-hour shift can probably operate and maintain all coal handling equipment up to an installed capacity of 450 Mw. The small bunker, made possible through this system, reduced capital outlay as the incremental bunker capacity cost was figured at $130 per ton. Future units also will have similar small bunkers. Each future unit will only require the addition of two short sections of conveyor.

BOOM CONVEYER deposits coal obtained from car dumper and track hopper into reclaim hopper. From here it is carried to bunkers. Active storage pile plus bunker capacity provides enough coal for three days' operation at full load

Comparative Cost

Complete with car dumper, electronic scales, dust control sprays, automatic feeder control by belt load, recorders, stocking boom, and all associated structures and controls, this arrangement costs no more than the conventional "track hopper to bunker and/or dead storage" system.

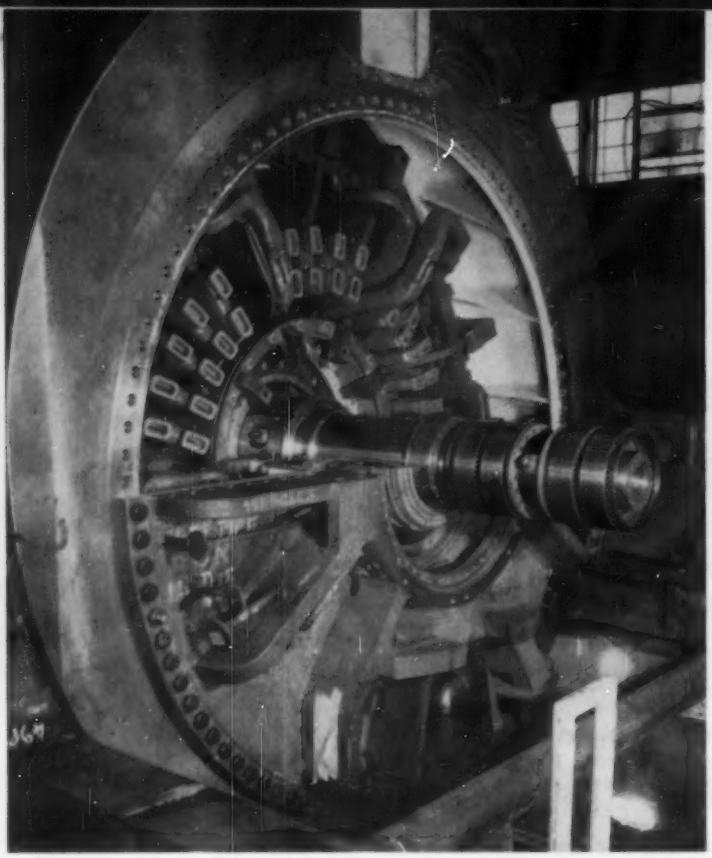
Because no natural or artificial ash settling pond was practical and because it was unthinkable to discharge ash laden conveying water into the lake, arrangements for reuse of all bottom ash sluicing and conveying water were made. All fly ash will be handled pneumatically and stored in an elevated silo equipped with dustless unloaders. The hydraulic bottom ash system will employ high pressure jets for cleaning the ash hopper and conveying. To avoid expensive maintenance of a high pressure pump system, the ash hopper will be flushed instead with a large quantity of low head water.

Steep Sides for Hopper

The ash hopper was designed with steep sides and pitched bottom to empty into two crushers each submerged in a sump. Ash and water discharge of the crushers will be pumped to an elevated decanting and draining storage tank. Water decanted and drained from this storage tank will be held at sufficient head in another tank to permit its reuse without pumping or flushing the furnace ash hopper and repeating the cycle. As a result, the bottom ash system consists of two large tanks, two crushers, two low head pumps, control valves, and associated piping. Fly ash and bottom ash will be removed to a remote disposal point by trucks.

No Travelling Screens

Because the intake extends some 400 ft off shore to a depth of 45 ft to take advantage of cold water available the year around, it was decided not to use travelling screens. Such an arrangement on another of our plants has given satisfactory results. The sub-



INNER-COOLING of both the rotor and stator windings of the generator has reduced length of the unit by 11 ft and increased the subtransient reactance

mersion of the intake pipe will prevent fouling by flotsam and minimized bottom agitation from surface storms. However, omission of screens will be compensated for by installing centrifugal circulating pumps of the sewage type capable of passing 6-in. dia objects.

Condenser reversing valves will be arranged to reverse automatically if the pressure differential through the condenser increases. An increase of four in. of water pressure will actuate the controls. Reversal will allow the water to flush any accumulated debris from the tube sheets.

Demineralizers Used

Because this plant is not served by a water company and large wells are not too satisfactory in a natural gas district, it was necessary to have an independent water treating system capable of producing water for all plant uses. An evaporator was too tightly integrated into the steam cycle for use as the makeup source in a single unit plant. Also as this is to be a multiple unit station, the economic advantages of demineralizers over use of evaporators became more attractive.

Lake water is of low turbidity with 275 ppm total solids. A battery of gravity filters handles incoming prechlorinated water. Part of the filter effluent will be held as "filtered and sterile" water. Remainder of filter effluent will go to the demineralizer system. The system will consist of a four-tank, two-bed demineralizer with an interstage vacuum degasifier. The degasifier will use the main condenser as a vacuum source. Either series or parallel operation will be possible with flows of 60 or 120 gpm.

Reheat Turbine Used

Initial tandem compound triple exhaust unit will have a nameplate rating of 135 Mw under throttle steam at 1,800 psi, 1,000F/1,000F reheat supplied by a tangentially fired pulverized coal steam generator capable of 1 million lb of steam per hr. Seven stages of feedwater heating will be employed.

Electrical Details

Generator will be rated at 135 Mw, 0.85-power factor, at 30 psig hydrogen pressure, and with a capability of 156 Mw, 0.85 power factor, at 45 psig hydrogen pressure. Unit will have inner-cooling of both rotor and stator and will be the first on the system.

Inner-cooled Windings

Inner-cooled windings are constructed with vents extending the full length of the coil. Cooling medium is introduced within the conductors of the stator as well as in the rotor. Copper heat loss is transferred directly to the cooling medium without having to pass through the coil insulation and core. Inner-cooling has resulted in reduction of the length of the unit by about 11 ft over a unit of equal rating with conventional cooling. Decreased space requirement of the generator resulted in substantial savings.

Efficiency Is Same

Efficiency of an inner-cooled unit is the same as a conventional unit with the advantage of increased subtransient reactance. This results in lower short circuit currents and a reduction in third harmonic generation.

Generator is designed to operate as a synchronous condenser during scheduled boiler and turbine outages. Rating for condenser operation at zero power factor will be about 75% of its normal rating.

The 850-kw main exciter will be connected to the main generator shaft through a 4-to-1 reduction gear. Main exciter will have three auxiliary field windings for magnetic amplifier voltage regulator in addition to the main shunt field winding.

Main Exciter Control

The main exciter rheostat will be manually set so that the self-excited field circuit provides a base value of exciter field current and voltage. This will furnish a base value of generator field current and a corresponding generator base voltage. The voltage regulator will control the output of the magnetic amplifier to buck or boost the base excitation of the exciter to maintain the pre-determined ac voltage as the load changes on the generator. Static limiting circuits will prevent lowering the excitation below a level which might permit the machine to fall out of step with the system.

Reserve and starting excitation will be supplied by a four unit motor-generator which will include a 1,500-hp squirrel cage motor, 850-kw reserve exciter, 125-kw starting exciter, and 15-kw pilot exciter. Reserve exciter will have a multiple field arrangement identical to that of the main exciter to permit automatic voltage regulation.

The advantage of this system is that of maintaining a preset base excitation of a conventional type (self-excited main exciter) separate from the automatic regular controlled boost or buck control field windings. With this arrangement failure of the regulator or magnetic amplifier does not cause loss of the generator field.

When operating the generator as a synchronous condenser, the turning gear will be used to accelerate the ac machine (uncoupled from the turbine) from 0 to 40 rpm. The reserve exciter, functioning as a generator, will supply dc power to drive the main exciter as a starting motor to accelerate the rotor from 40 rpm to 3,600 rpm for synchronizing. Under this condition both dc machines will be separately excited from the pilot exciter which is a part of the MG set. The starting exciter, another part of the MG set, will be used to provide synchronizing excitation to the ac machine field. After synchronizing, the condenser field can be supplied by either the normal main exciter or reserve exciter.

Main generator leads, rated 13.8 kv, 8,000 amp self-cooled, will comprise some of the highest rated bus duct sections built to date. Conductors will be square copper tubing, 11 in. on a side with a $\frac{1}{8}$ in. thick sheet aluminum covering 31 in. in diameter. Bus duct is designed to withstand the thermal and mechanical forces incident to short circuit stresses of 190,000 rms amp assymetrical.

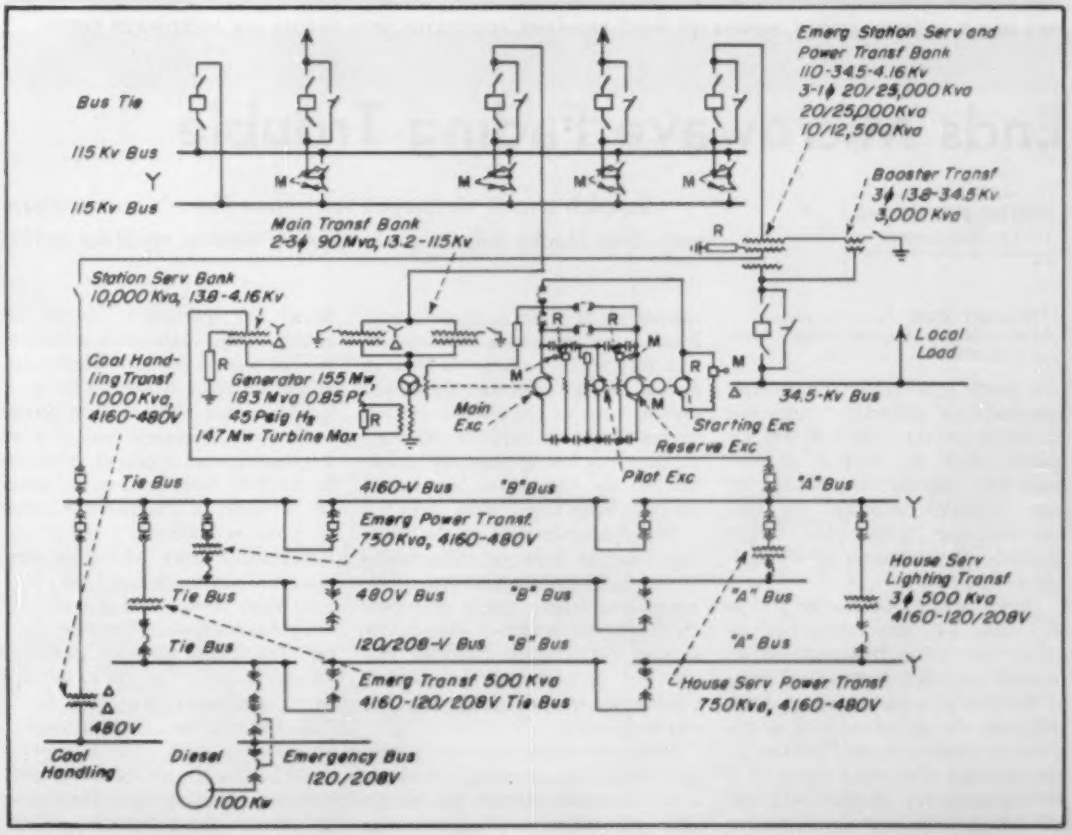
The control room is designed to provide centralized control for two units. It will be located between them. All boards will be of vertical face, tunnel-type construction. For the first unit some 54 ft of panel will be required with a floor area of 560 sq ft. This will be increased when the second unit is added. The room will be air conditioned and ventilation will be arranged to prevent dust from depositing in the instruments. A symmetrical yet functional instrument arrangement will be employed.

Each section of the board will have its own "scam" annunciator system employing a two-relay circuit with back-lighted engraved name plates. All annunciator components can be serviced from the front of the boards through the use of canned plug-in units.

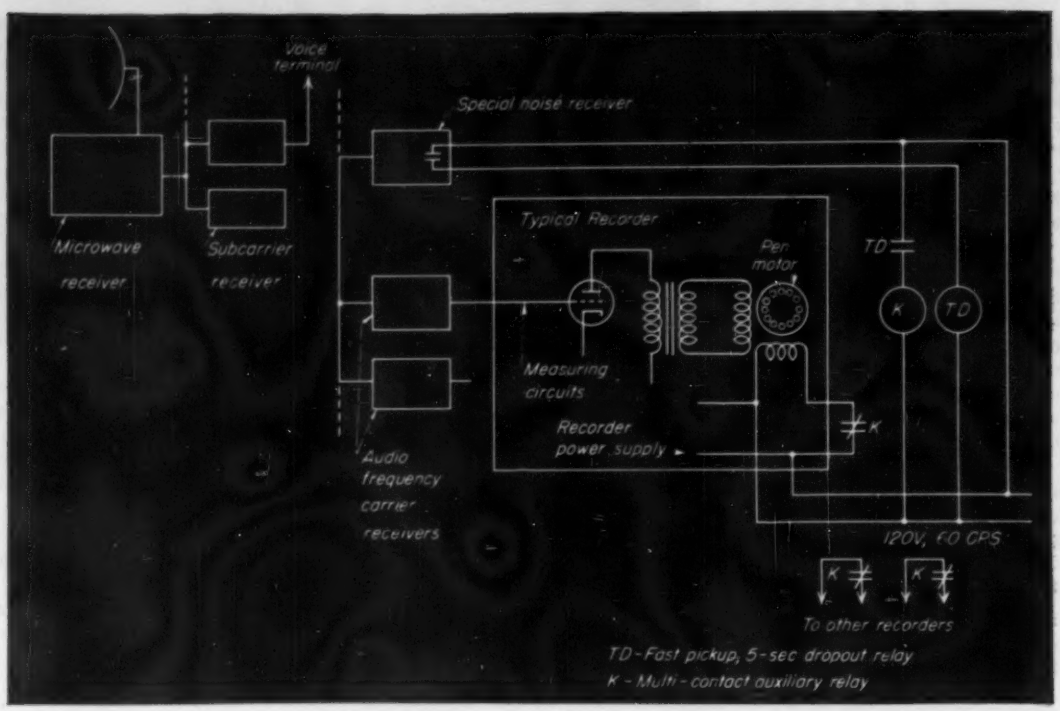
Two operators will be required for the first unit; a third operator will be added for the second unit. All operators will be trained to operate both the mechanical and electrical sections of the boards.

The main power transformers were

(*Continued on page* 164)



BOOSTER TRANSFORMER permits use of low tap on HV winding of emergency service transformer for 115 kv thus providing higher taps for future 123-kv operation. This permits use of existing transformer for this emergency service



THIS SIMPLE SQUELCH CIRCUIT ELIMINATED MOST PROBLEMS ASSOCIATED WITH FADING ON MICROWAVE SYSTEM

Ends Microwave Fading Trouble

SYSTEM ENGINEERING
Communication

Squelch circuit, developed for Illinois Power's carrier channels, also blocks noise signals causing wanton recorder action

A. STUART COX, Telemeter and Communication Engineer, Illinois Power Co, Decatur, Ill.

A simple squelch circuit eliminated practically all difficulties attributable to fading on the Illinois Power Co system which has enjoyed a better than 99% microwave reliability. It was developed originally for telemetering over power line carrier channels, the telemetering channels being triple FM.

During a fade, the reserve gain in the video I-F strip, subcarrier receiver, and audio frequency carrier receiver amplified background noise to the level of a normal signal. Consequently, the output relay of an impulse telemeter channel worked at random, and the output signal of a variable-frequency channel is a signal voltage of normal amplitude but random frequency.

These output signals drove the mechanism of modern quick-response telemeter recorders back and forth and with such violence against the stops as to cause broken pens, torn charts, and eventual loss of calibration. A fast-response, impulse-duration telemeter receiver was first applied on the system on an AM power line carrier channel, using keyed audio tones.

High-frequency noise on the power line, resulting from switching operations or lightning storms near the lines, caused the erratic action described. Oscillographic study of the carrier channel performance indicated that for that particular carrier receiver bandwidth improvement of equipment was not possible.

When the fading problem became apparent on the microwave channels, a second carrier receiver was set up. This was tuned to an unused frequency, and its sensitivity was adjusted so that a relay in the plate circuit was operated by carrier frequency noise. This relay effectively blocked wanton recorder activity originated by noise signals. This setup has functioned with excellent results.

An audio frequency receiver panel installed on each telemeter subcarrier has its filters tuned to an unused channel. Presence of a noise signal passed by a receiver operates a fast-pickup, slow-dropout relay which, in turn, picks up a fast multi-contact relay. Each relay contact blocks a recorder using that microwave subcarrier channel. The scheme has been applied to variable-frequency as well as impulse-duration telemeter channels.

A fast-response recorder uses a measuring circuit to produce a voltage which is varied by the incoming signal. It has a self-balancing potentiometer to measure and record the voltage. The recorder pen is positioned by a small two-phase servo motor, one

winding of which receives constant excitation from the recorder power supply. An electronic amplifier excites the other winding, excitation varying in phase and amplitude with the error in the potentiometer circuit.

False Signals Uneffective

The squelch relay contact opens the circuit to the constant potential winding of the pen motor. Thus the motor cannot change the recorder reading during loss of normal signal nor during a period following resumption of normal conditions long enough for the measuring circuits to stabilize. The impulse-duration telemeter uses a 2.4-sec cycle. A complete normal impulse must be received before the recorder measuring circuits return to normal. Consequently, there is a minimum delay of twice the period of the impulses or about 5 sec.

When subcarrier noise indicates interference, the squelch receiver relays operate. Their action de-energizes the recorder pen motor winding before the measuring circuits can operate on false signals to change the recorder position. As soon as the interference disappears, the time-delay relay is de-energized and after 5 sec drops out, energizing the pen motor. During the 5-sec delay, measuring circuits operate normally so that the recorder shows the correct indication as soon as the motor is energized.

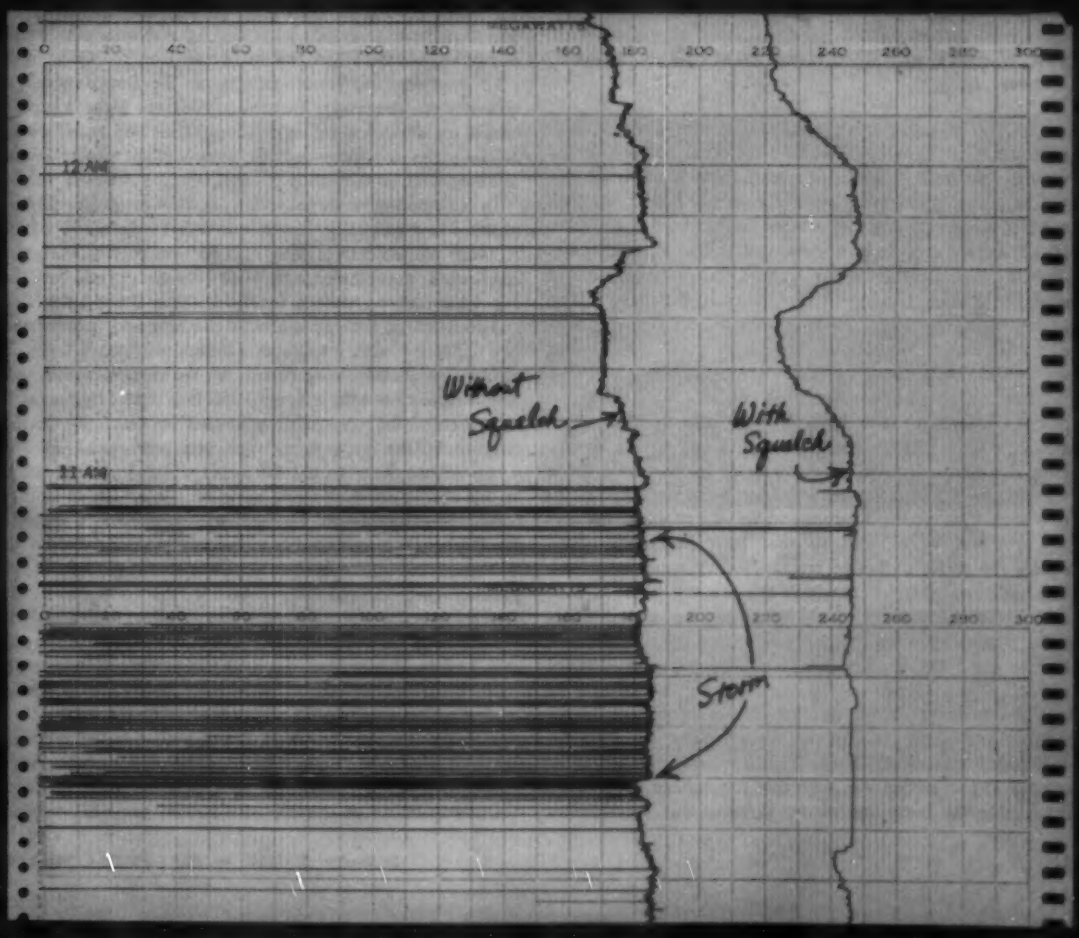
Only long fades leave evidence on the chart of a recorder thus protected. The recorder shows a smooth straight line, not the irregular line characteristic of power interchange records. Equipment operation remains the same for other outages not dealt with here, such as loss of power supply at a repeater station, equipment failure causing outage of the microwave path, or interruption for maintenance.

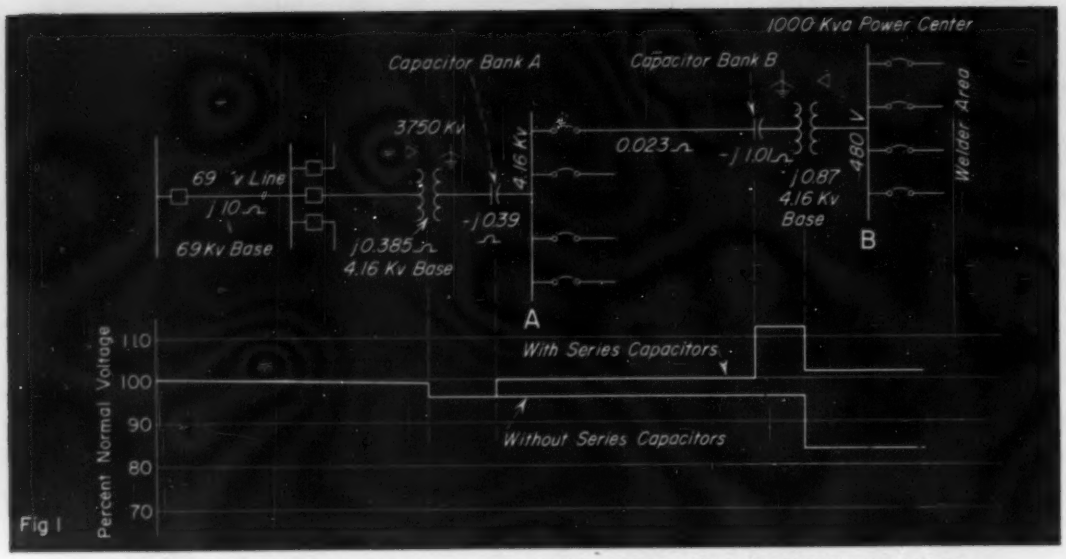
This equipment is used also at power stations under automatic load control, where it interrupts the governor control impulse channels and prevents possible changes in generation consequential to fading conditions. While they have yet to be tried, the principles of this squelch circuit, the author believes, are applicable to the older type of mechanical, self-balancing potentiometer telemeter recorder. The squelch relays would open the normal circuit to the galvanometer and short it through a damping resistance. The recorder would then remain at zero deflection until correct telemeter conditions obtain.

Serious Error Possible

The scheme does not provide information when none is actually being received, and there is always the possibility of serious error in assuming that system conditions have not altered during a channel interruption. So far, this difficulty has not occurred.

EFFECT OF STORM ON RECEPTION ON TWO-PEN RECORDER CHART WITH (RT) AND WITHOUT (LT) SQUELCH SCHEME





SERIES CAPACITORS INSTALLED IN DISTRIBUTION CIRCUIT SOLVED PROBLEM OF VOLTAGE FLICKER

Series Capacitors Foil Flicker

INDUSTRIAL Design

Solve voltage problem at minimum cost. Eliminate flicker at 4,160 bus, providing strong power for welders and other machines

T. H. McGREER, Engineer, Sargent & Lundy, Consulting Engineers, Chicago, Ill.

Modern manufacturing methods require good voltage regulation. But many established electric devices cause voltage fluctuations. Notable among these is the resistance welder. The greatest difficulty comes when two or more welders on the same phase are operating at the same time. If the voltage drop is severe enough, welds may be faulty.

Series capacitors are often the best and most economical solution to such problems. They are simple, require little attention in operation, help to regulate average voltage, eliminate rapid fluctuations, and accomplish these things without effecting short circuit current on other machines.

To solve such a voltage problem at the Maytag Co plant in Newton, Iowa, two sets of capacitors were installed in series in distribution circuits serving the welder load. Separate installations were made so that the voltage rise due to the capacitors would not be too severe at any one point (See circuit diagram and voltage profile).

Capacitors were sized so that their reactance about equals the series inductive reactance they were to cancel. The industrial district in which the Maytag plant is situated is fed at 69 kv over a single transmission line. This voltage is stepped down to 4,160 v through a 3,750-kva transformer. Distribution is over radial feeders to all types of load.

Voltage drops shown on the voltage profile of Fig 1 were caused by a combination of welders drawing a 1,000-kva peak at 40% power factor, single phase. Frequency of recurrence was such that the voltage drops were intolerable on both the welder circuits and the 4,160-v bus but could be taken reasonably well on the 69-kv bus.

In applying the series capacitors, the impedances involved were the major factors considered. Sizes were selected to allow for future load growth. The small effect of the series capacitors on the overall plant power factor was neglected in the study.

In calculating voltage levels, a voltage drop of 6% at the 480-v bus, B, in Fig 1, and 1% at the 4,160-v bus, A, were the objectives sought. The voltage rise that was considered acceptable was 10% above normal at the capacitor and no rise at the load. This limited the size and location of the capacitor installations and necessitated two capacitor bank installations instead of one.

One installation, regardless of the location selected, would have raised the voltage 16% if it were large enough to overcome the voltage drop caused by reactance in the circuit. If the capacitors were installed ahead of the 4,160-v bus, there would be a net voltage rise of 12% at the bus. This would not be permissible. On the other hand, capacitors on the load side of this bus will not affect the bus voltage appreciably. Therefore the installation of a single bank in the feeder to power center B would not produce the desired improvement in voltage at the 4,160-v bus.

For these reasons, one capacitor installation was made at A and another was made at B, Fig 1. The capacitive reactance of the installation at A is equal to the inductive reactance of the main transformer. The capacitive reactance of the installation at B is equal in rated reactive ohms to 106% of the combined cable and power center transformer impedance.

Current rating of the capacitors must be equal to that

of the circuit in which they are installed. For the incoming circuit, the 3,750-kva transformer rated current is 520 amp and that of the 1,600-kva power transformer is 139 amp.

Voltage drop at full load through the capacitor banks is 203 v at A and 138 v at B. At A, with full load on the circuit, momentary peaks caused by welders will be 880 amp. Peak voltage across the capacitors will be 332. Therefore, 18 units per phase—each rated at 7.05 ohms 230 v, 15 kvar—were installed at A. The 332 peak voltage on the capacitors is well within the limits of the 230-v units.

Calculated peak voltage across the capacitors at B was 417 v. This is 181% of the rating of 230-v capacitors; but as these peaks are reached only occasionally 230-v capacitors were installed. The installation at B consists of seven 230-v, 7.05-ohm, 15-kvar capacitors. This produces a 12% voltage rise at the power center which is above the 10% set as the objective. Therefore, sufficient space was provided in the capacitor housing for the installation of an additional capacitor in case a ferro-resonant condition should develop.

Gap Protects Capacitors Against Shorts

In case of a short circuit beyond the capacitor there would be a heavy current as most of the inductive reactance of the circuit has been offset by capacitive reactance. For this reason the capacitors are paralleled by a gap (see Fig 2) that flashes over before a high over-voltage is reached across the capacitors. Once breakdown has occurred, the gap, for all practical purposes, short circuits the capacitors and returns the circuit to normal condition without capacitors. In this way the capacitor does not increase the interrupting duty on the breakers nor cause serious over-voltages on other parts of the circuit.

This gap can carry the short circuit current long enough for the fuses or circuit breakers to clear the fault. However, once the current arcs, the gap cannot recover its dielectric strength without help. The arc will continue until the circuit is deenergized or the gap is by-passed.

The gap is by-passed by a relay and circuit breaker (Fig 2). The gap current actuates a relay causing the circuit breaker to close. This by-passes the gap and stops the discharge. The circuit breaker may be reopened immediately without causing a second breakdown of the arc, provided the short-circuit has been removed.

A less costly scheme uses a gap that short-circuits when flashover occurs. The capacitors cannot be returned to service with this scheme until the gap is replaced. If operating conditions are such that this can be tolerated, a considerable saving is possible.

Disconnect Switches Speed Maintenance

To provide for maintaining the capacitors at A, three 3-pole disconnect switches were installed as shown in Fig 2. To take the capacitors out of service, they are first by-passed by closing one disconnect and then removed from the circuit by opening the other two disconnects. Interlocks were provided to prevent an error in the sequence of operation.

The disconnect switches were not included for the capacitors at B because the feeder breaker can be opened while capacitors are being maintained. But interlocks were provided here to prevent operating errors. If the power center at B were too important to permit sufficient shutdown time for maintenance, by-pass equipment, similar to that at A, would be required.

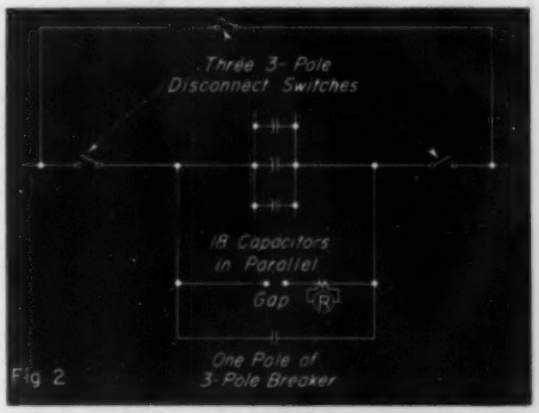
At B the capacitor by-pass breaker and the feeder breaker are interlocked so that the feeder breaker cannot be closed until the capacitor is by-passed. The reason for this is that the magnetizing inrush current to the transformer is great enough to cause a gap flashover when the circuit breaker is closed. This results in an automatic operation of the circuit breaker; and although it does no harm, except to decrease the life of the gap, such operations are not desirable.

Excellent, Economic Performance

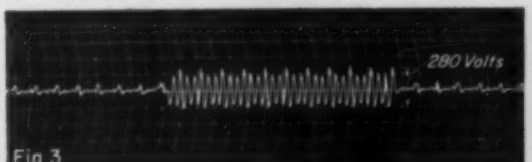
Calculated results have been realized within narrow limits. Voltage at the 4,160-v and 480-v buses is free from change, except from conditions on the 69-kv system. No other economical method would have achieved such results.

There is still an occasional 5 or 6% voltage drop at the 480-v welders and many smaller variations, but they are within tolerable limits for welders and machinery operations.

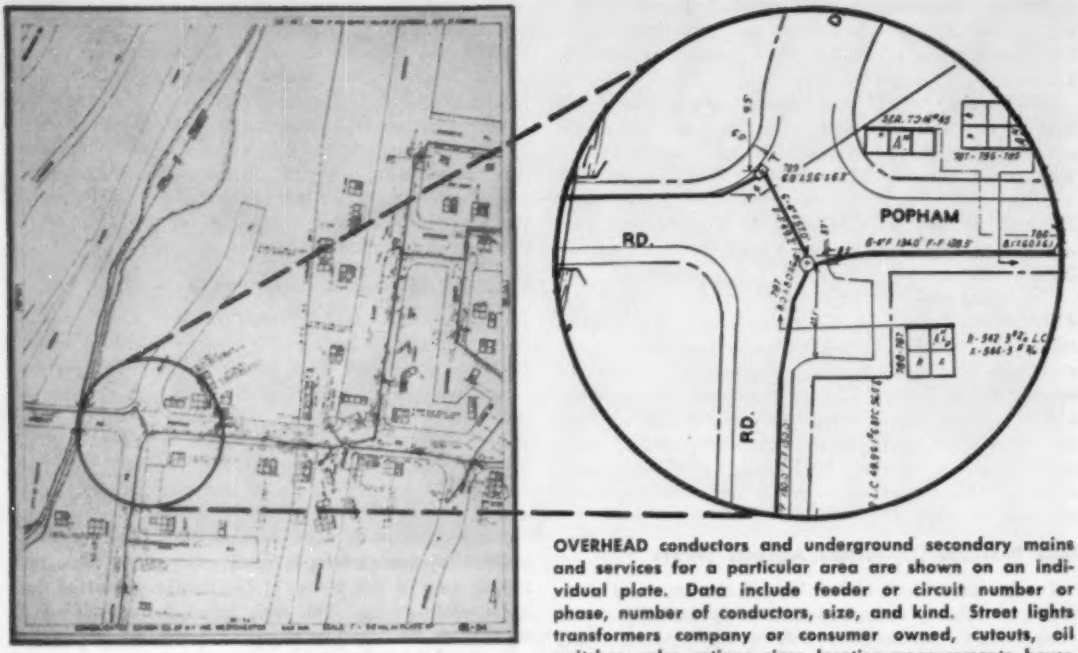
The oscillogram of Fig 3 shows the voltage drop across a series capacitor serving a group of welders. Note that a peak drop of 280 v—an 11.7% change—occurred during a welding cycle. This drop across the capacitor subtracts from the drop due to transformer reactance so that a load voltage drop approaching 11.7% was prevented by the capacitors. A seam welder, striking every third cycle, was operating at the time as evidenced by the smaller peak occurring at that frequency. Without the capacitor there would have been a possibility of a defective portion in the seam weld because of low voltage during the period when both welders were operating.



SHORT CIRCUIT would throw full voltage across capacitors. But spark gap and breaker provide shunt paths in emergency



VOLTAGE DROP across series capacitor serving welders hits 280 v, but this subtracts from transformer reactance drop



OVERHEAD conductors and underground secondary mains and services for a particular area are shown on an individual plate. Data include feeder or circuit number or phase, number of conductors, size, and kind. Street lights transformers company or consumer owned, cutouts, oil switches, poles, ratings, sizes, location measurements; house and lamp services, number size, phase, and length are given. Buildings served by underground secondary are indicated.

New System Operating Maps Offer

DISTRIBUTION
Operation-Maintenance

Number required reduced 94% with no sacrifice of information. Changes cut sharply labor, material, and perpetuation expenses

G. B. ELKINGTON, Supervisor, Drafting and Record Bureau, Consolidated Edison Co of N. Y., Mount Vernon, N. Y.

Replacing 168,950 assorted gas and electric maps and associated records with 9,753 new operating map plates has resulted in greater efficiency of operation in Consolidated Edison Co's Westchester County territory. This 94% saving has been accomplished with no sacrifice of information. Other benefits have been:

1. Reduced labor and material costs for the reproduction of revised prints of the new record.

2. Reduction of office space and filing equipment requirements.

3. Reduction of perpetuation costs of completed construction layouts.

The new gas and electric operating map system was completed in three years and nine months. Original estimate for the job was three years. Dollar-wise the actual cost was comfortably below the estimate.

The new system of mapping was originally developed through the efforts of a representative group, the "Map Standardization Committee."

Basis of the system (EW, July 30, 1951, p 88) is a group of geographical maps which have provisions for:

1. A plate for electric underground trunk ducts, structures, and duct occupancy.

Modernization Benefits

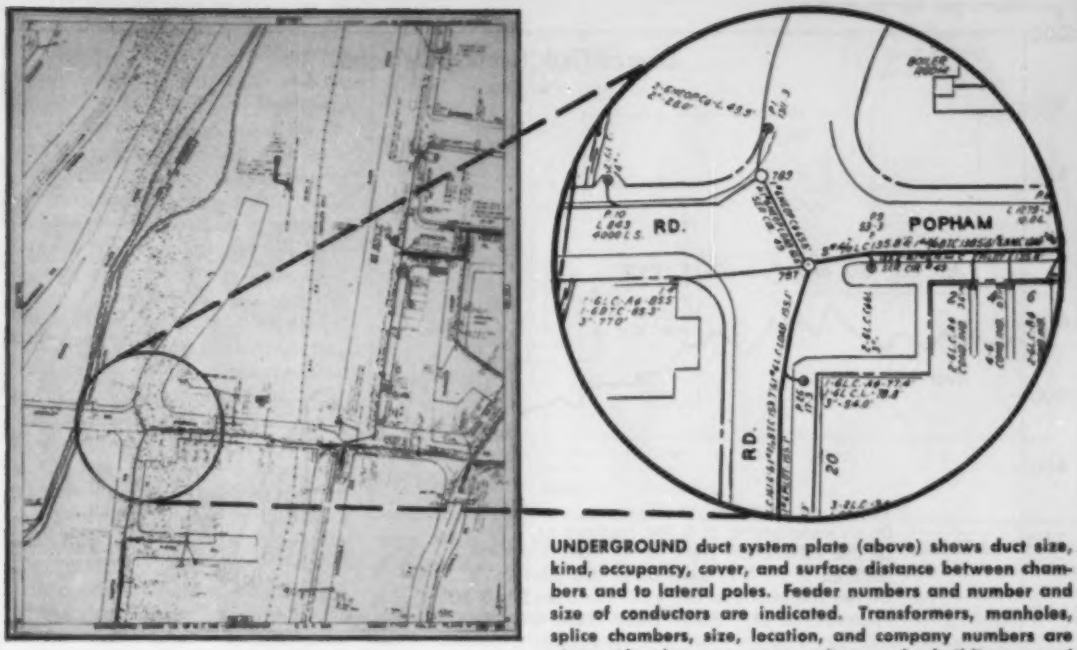
1. Greater efficiency of operation with no sacrifice in information.
2. Reduced labor and material costs for the reproduction of revised prints.
3. Reduction of office space and filing cabinet requirements.
4. Reduction of perpetuation costs.
5. Complete record of plant data.
6. Complete record of permit information.

2. A separate plate for the overhead conductors and underground secondary mains and services.

3. A plate for gas mains and service facilities. Entire service area is drawn at scales of 1 in. to 25 ft, 1 in. to 50 ft, 1 in. to 100 ft, and 1 in. to 200 ft. Scale of any plate areas was determined by the density of the plant in that area. All three plates of the same area were drawn to the same scale. However, if any one section of outside plant installation had a complicated corner, a detail was drawn on a sub-plate. This eliminated making the entire set of three plates at a larger than ordinarily required scale.

All plates are 20 x 25 in. with a half-inch border providing a working area of 19 x 24 in. Plates do not require overlapping because border lines serve as match lines. Reference numbers for adjoining plates are provided.

It was originally felt that the problem was not plant data but rather the vastness of the record system. Cer-



UNDERGROUND duct system plate (above) shows duct size, kind, occupancy, cover, and surface distance between chambers and to lateral poles. Feeder numbers and number and size of conductors are indicated. Transformers, manholes, splice chambers, size, location, and company numbers are given. Also shown are property lines, curbs, buildings served by the underground secondary system, and miscellaneous information.

More Data Cheaper and Faster

tainly it was vast and top heavy, but the plant data provided the big surprises. Or more correctly stated, the absence of plant data provided the big surprises. The job of transcribing plant revealed poles without conductors, transformers without primaries, secondaries without transformers, gas services without gas mains, etc. The discovery of their existance was an asset because they served as an unexpected source for applying further dollar savings to the project. In many of these instances it was material dollars added to the capital record, and in other cases intangible dollars which will be certainly realized in operation and planning.

Many new procedures and studies have been stimulated by the development of the new operating map record. One plan adopted was the maintenance by machine tabulating system of the alphabetical street indices that are used for the map record. A supplementary record was developed of all streets indicating the primary feeder by map plate numbers. This index system will be used as a rapid source of information in coding "no light tickets" in the early stages of major emergencies.

Another feature adopted was the incorporation of the map plate grid on the 4-kv operating diagrams. All 4-kv diagrams are drawn to scale and use the plate grid of the master map. This provides rapid cross reference to the operating map for any detailed information that may be required. In addition to being a time saver in emergencies, it also aids the drafting room in perpetuation of both the operating maps and diagrams.

Still another feature added is the recording of permit information. This information has always been obscure and muddled. Acquisition or cancellation of permits and the checking of the invoices for these locations were not only aggravating chores in the past but also time consuming. These data, after a field check, were applied to maps, and it was found that in many instances payments had been made on plant no longer existing.

An unanticipated saving occurred when it became necessary to change the operating district boundary lines. A change in telephone toll rates made this adjustment necessary so that customers would not have an added expense in contacting the company.

These boundary changes, which swapped large areas from one district to another, were comparatively simple readjustment to the line from one series of plates to another. This was possible because the new design covers the entire county with no breaks at district lines. Changes required layout and drafting of the new line on 368 gas and electric detail map plates at a cost of about $1,200. Under the old map system an estimate indicated 2,823 maps would have been changed at a cost of about $15,000.

The economies obtained in recording completed construction layouts on the new map system is very gratifying. A comparison with the old system indicates why this is so.

For purposes of clarity in the discussion no printing or other miscellaneous requirements are considered. Also, a complete construction layout, large or small, is called "unit".

In the three years prior to the inception of the new system, 33,000

(*Continued on page* 162)

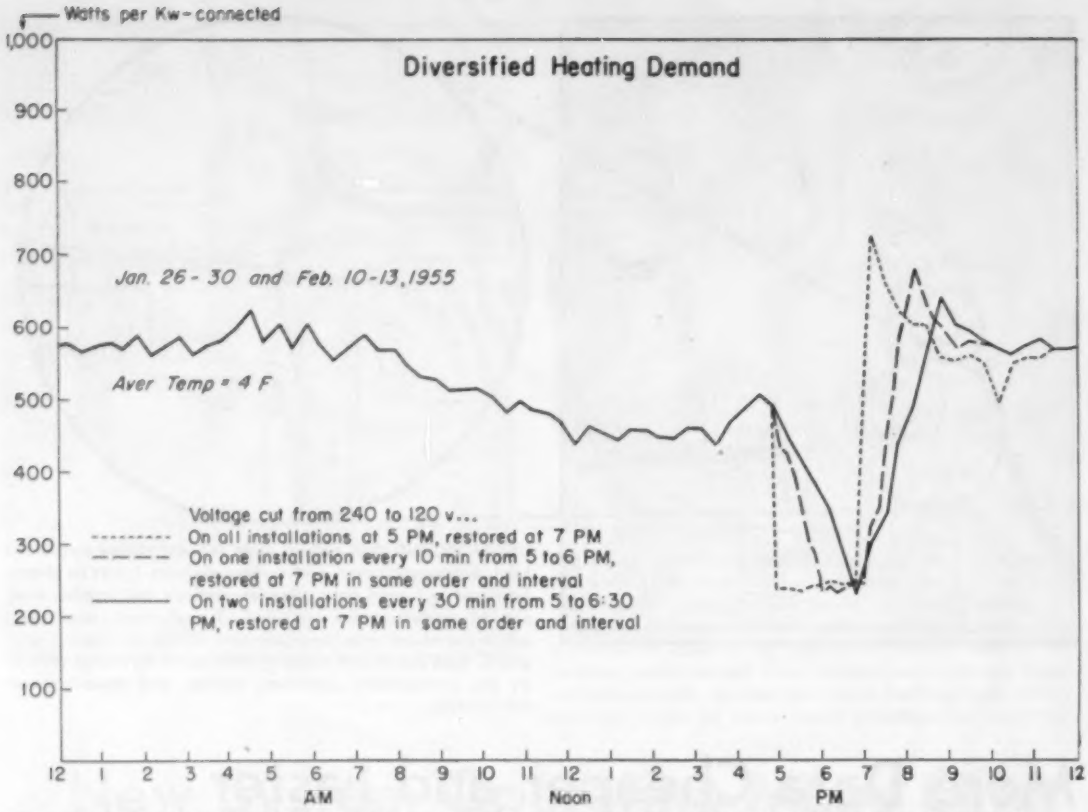

Watts per Kw-connected
Diversified Heating Demand
Jan. 26 - 30 and Feb. 10-13, 1955
Aver Temp = 4 F
Voltage cut from 240 to 120 v...
On all installations at 5 PM, restored at 7 PM
On one installation every 10 min from 5 to 6 PM, restored at 7 PM in same order and interval
On two installations every 30 min from 5 to 6:30 PM, restored at 7 PM in same order and interval
1,000
900
800
700
600
500
400
300
200
100
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
AM
Noon
PM

FIG 1—HEATING LOAD CAN BE CONTROLLED TO MINIMIZE HEAT RECOVERY AFTER REDUCED-VOLTAGE OPERATION

Heating Can Be Off-Peak Load

SALES
Residential

Tests validate half-voltage operation even in cold weather and prove staggered time clock settings reduce heat-recovery load

DAVID S. WELCH, Chief Engineer, Illinois Rural Electric Co, Winchester, Ill. and

VIRGIL S. BERRY, Radiant Glass Distributors, Springfield, Ill.

Electric house heating load can be controlled to minimize its effect at time of system peak. Furthermore, even in zero weather resistance heating can be operated at half voltage as long as 2 hr, and staggered time clock settings can significantly reduce the heat-recovery load.

These conclusions are supported by the results of system tests conducted by the Illinois Rural Electric Co, the Corn Belt Electric Cooperative, and the Adams Electric Cooperative. Tests were made between Dec. 1 and April 15 on 12 installations in homes of from 7,800 to 15,000 cu ft with connected heating loads of 9 to 18 kw.

Seven installations yielded the complete and mutually collatable data upon which the accompanying charts were based. According to S. R. Faris, manager of the Illinois Rural Electric Co, at no time during the tests did an occupant of any home complain of discomfort from lack of heat.

"Our people who are using electric heating in their homes are enthusiastic in their praise of it," Faris said. "We have never received a complaint about the operation or the cost, even from those whose installations have reduced voltage controls.

"We have given those people plenty of opportunity to tell us about faults or undesirable features of their electric heating, especially those whose dual-voltage controls were tested last winter. Our representative called on them once a week during the entire winter to read various meters we had installed and to interview the users primarily to determine whether they experienced any discomfort from lack of heat during our system peaks when their heating units were operated at half voltage.

"Reports of these interviews," he continued, "indicate that even though these users had been informed that voltage would be reduced on their heating units during certain hours of the day, they did not experience any noticeable drop in the temperature in their homes.

"The tests we have made so far indicate that dual-voltage control can be employed successfully on any job installed with full insulation and engineered to proper input. Controlled heating reduces demands and the investment for such a load to a minimum, thus placing it in the category of a very desirable load. It also makes possible the establishment of a special rate for home heating that will make it more attractive to the consumer."

Fig 1 summarizes data for the seven coldest days, Jan. 26 to 30, and Feb. 10 to 13, when the average temperature was 4F. It shows the effect of time clocks operating on three different schedules. In one, all clocks were set to reduce voltage from 240 to 120 v at 5 PM and to restore the higher voltage at 7 PM. The effect of this operation appears in the sharp load drop and steep rise caused by heat recovery (dotted line).

The long-dash line gives the effect of reducing voltage on seven installations one at a time at 10-min intervals beginning at 5 PM, all installations operating at 120 v from 6 to 7 PM and then returning to full voltage in the same order. In this curve the heat-recovery rise is less steep, continuing for about 1½ hr, and is more than 40 w per kw lower than when all installations operated at reduced voltage from 5 to 7 PM.

The third condition, illustrated by the solid line, is also a staggered operation. In this instance, however, two installations went on reduced voltage at 5 PM, two more at 5:30 PM, two at 6 PM, and the seventh at 6:30 PM. Beginning at 7 PM, the

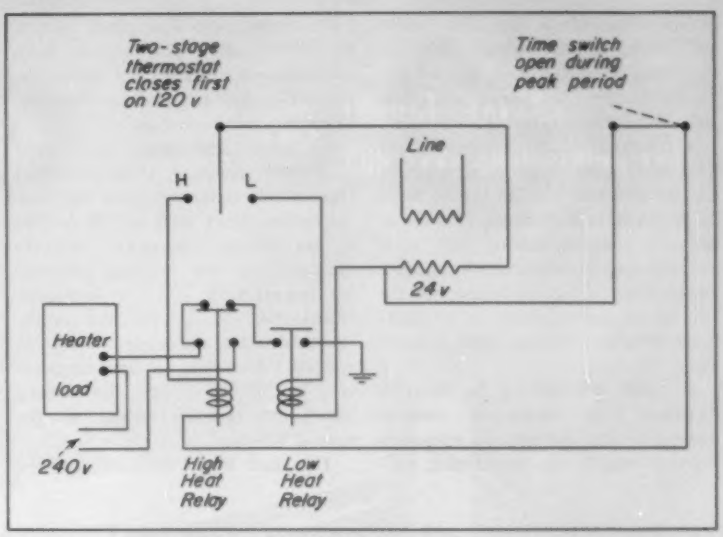
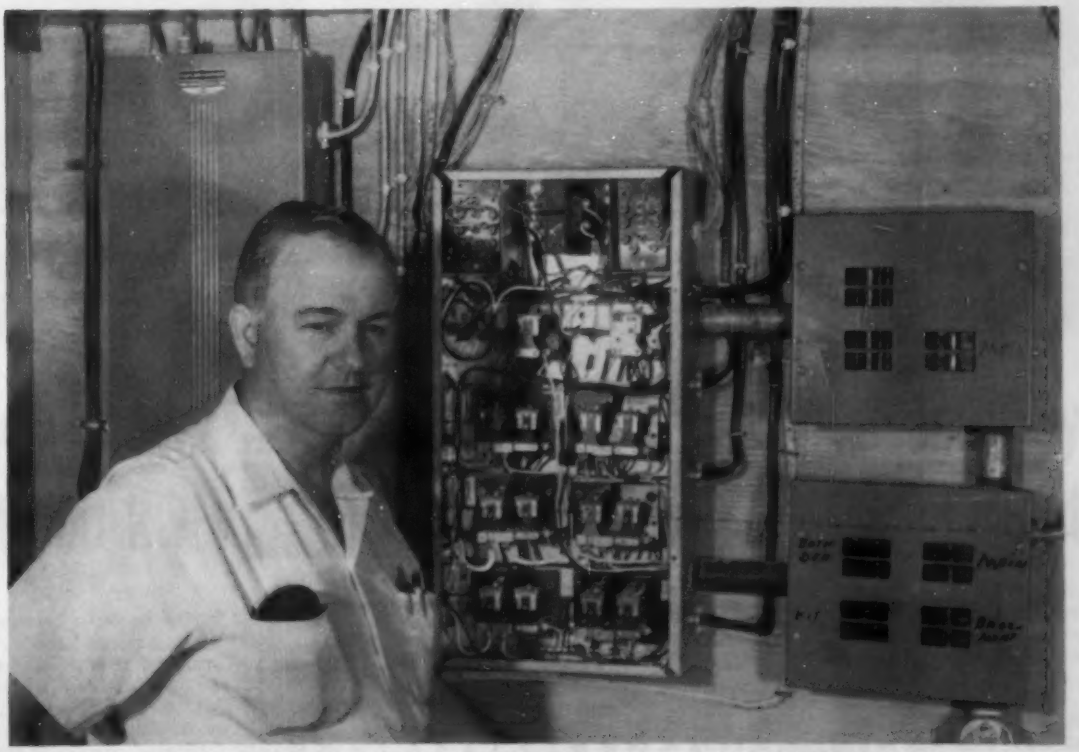


FIG 2—HOME HEATING INSTALLATIONS always start operation at 120 v and then, if thermostats are not satisfied, the equipment switches on to 240-v operation



MIDWEST CO-OPS HAVE RECEIVED NO COMPLAINTS ABOUT OPERATION OR COST OF VOLTAGE-CONTROLLED HEATING

groups returned in the same order and timing to full voltage. The result was a much more relaxed recovery, reaching the lowest and latest peak of all three manners of control.

A condition which probably should have been noted earlier is apparent in all charts: There was no setting back of thermostats at bedtime. No curve shows a morning heating load, such as is generally expected by people whose ideas of electric house heating load characteristics are based on practices common with combustion heating.

A point that cannot be overemphasized with regard to electric heating is that economical operation depends largely on maintaining uniform temperature throughout the 24 hr of the day. Such temperature maintenance obviates the heavy inputs of energy required to warm up a cooled-down structure.

All heating installations tested were in homes equipped with individual room thermostats, voltage on the heaters cycling from zero to 120 to 240 v. As the control circuit diagram indicates, the first response to heating requirements is 120-v operation. When this voltage does not satisfy the thermostat, the higher voltage is applied. When the outdoor temperature is 30F or higher, the heating installation operates almost all the time at 120 v.

This fact is apparent in the five load-temperature curves, showing watts demand per kw of connected load at average daily temperatures of 51, 41, 30, and 4F. Only the curves for the two lowest average temperatures reveal the effect of time clocks controlling high-voltage operation between 5 and 7 PM.

It is patent from the test results that electric house heating load is amenable to a degree of control entitling it to special consideration in rate making. In view of the generally accelerating rate of increase of summer load on practically all supply systems, it appears that promotion of house heating at rates recognizing its desirability is the next step in extending the scope of electrical living.

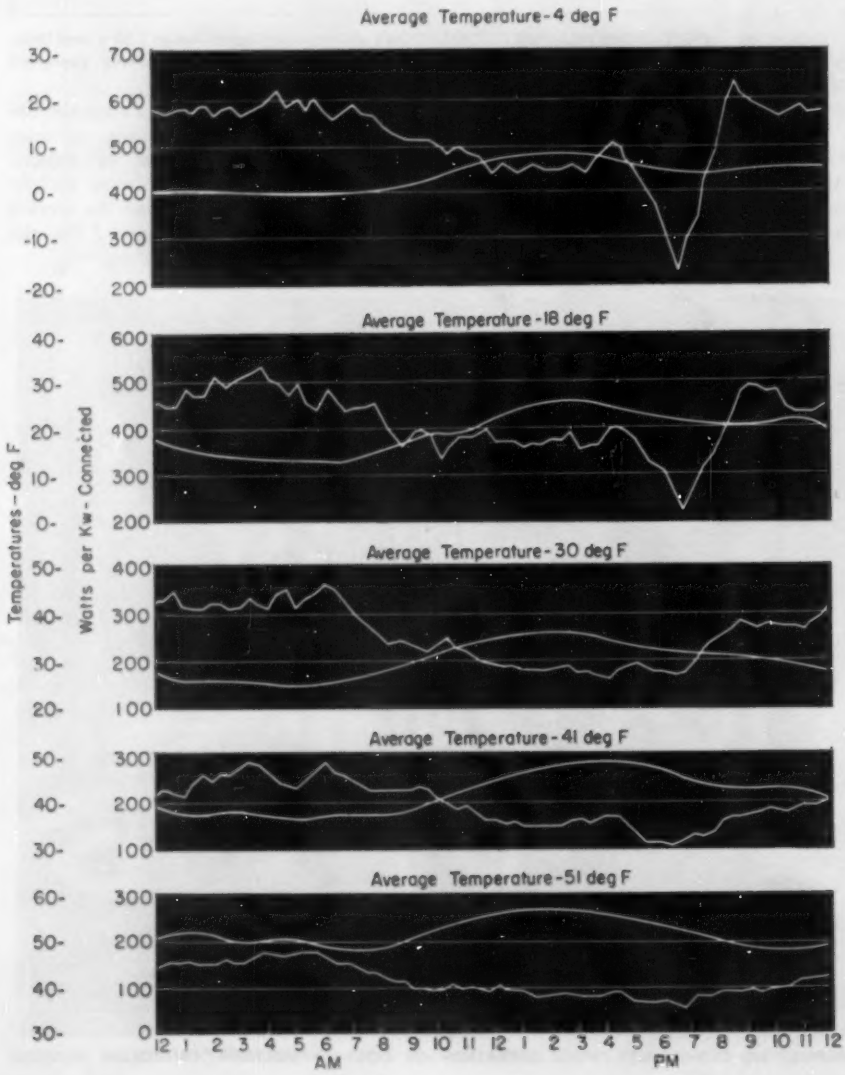
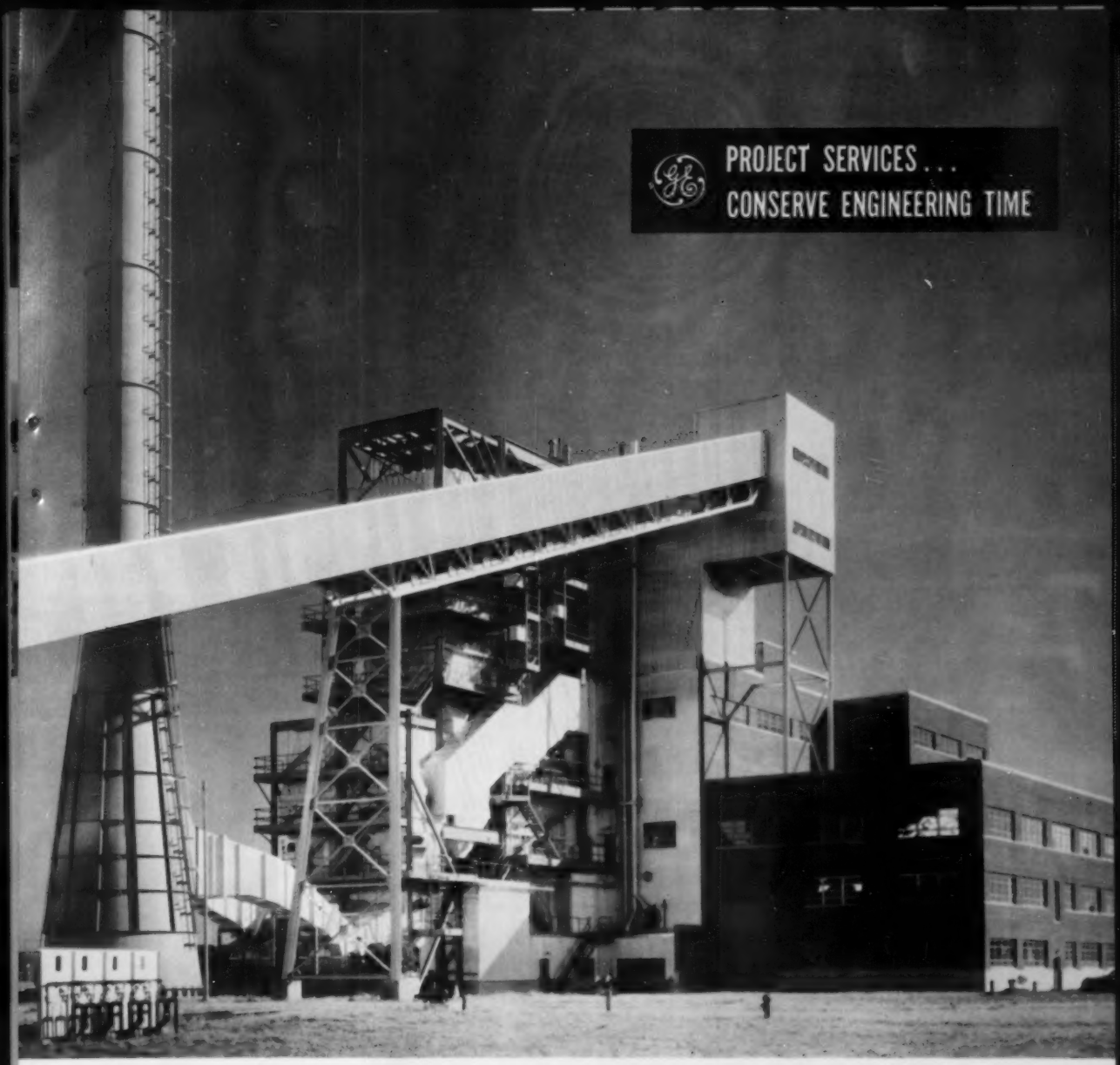

Average Temperature - 4 deg F
Average Temperature - 18 deg F
Average Temperature - 30 deg F
Average Temperature - 41 deg F
Average Temperature - 51 deg F
Temperatures - deg F
Watts per Kw - Connected
30- 20- 10- 0- -10- -20-
700 600 500 400 300 200
40- 30- 20- 10- 0-
600 500 400 300 200
50- 40- 30- 20-
400 300 200 100
50- 40- 30-
300 200 100
60- 50- 40- 30-
300 200 100 0
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
AM
PM

FIG 3—ABSENCE of high morning peaks on graphs shows result of fixed thermostat settings. Curves show heaters operate normally at 120 v since the effect of control is apparent only when the outside temperatures are pretty low



Iowa Power & Light steps up system capacity by 44,000 kw with G.E.-equipped Council Bluffs plant

Continued rapid growth of Iowa's industrial and residential load pointed to the need for increased generation facilities in western Iowa. With boldness and foresight, IPALCO climaxed a four-year expansion program with the new Council Bluffs steam station. This 9½-million dollar investment provides an increase in system capacity of 44,000 kw.

Working closely with Black & Veatch, Consulting Engineers, and IPALCO, General Electric assigned a project team to the Council Bluffs station to give valuable assistance in helping to keep construction abreast of schedule and holding total cost within budget restrictions.

GENERAL ELECTRIC

For more station data see next page ►

PROJECT SERVICES REPORT:

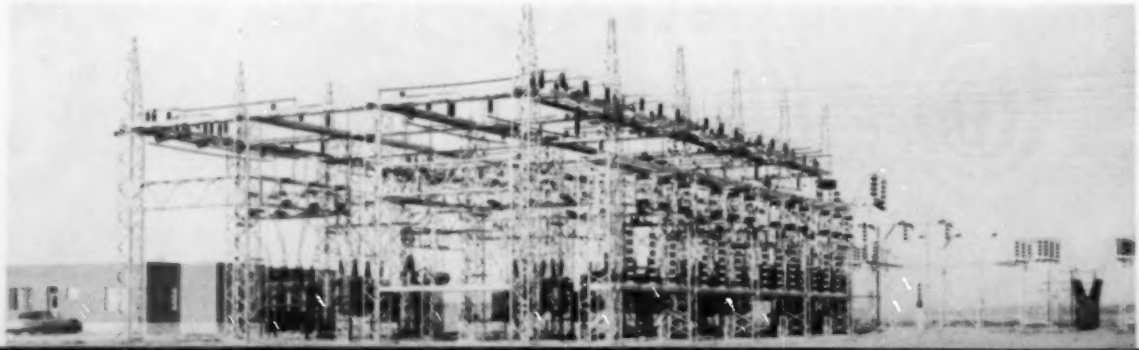
44,000 KW TURBINE-GENERATOR helps IPALCO meet growing power requirements. The General Electric project team met all specifications and coordinated related equipment design details for IPALCO, Black and Veatch engineers.

G. E. helps IPALCO, Black & Veatch cut

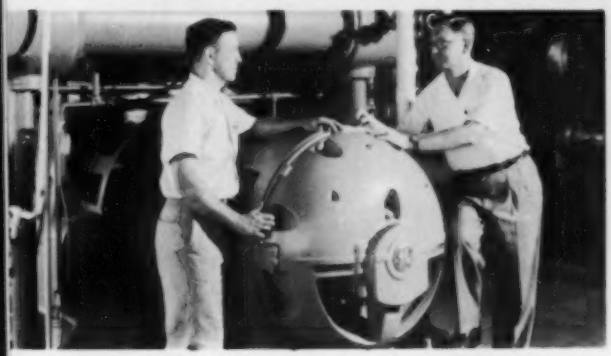
FIRST STEP was conference of F. A. Beaty, IPALCO V. P. (left); R. H. Miller, G. E.; and N. Bernard Gussett, Pres. of IPALCO.

PACKAGED CONTROL BOARD enables operators to secure maximum benefits from station's flexible design.

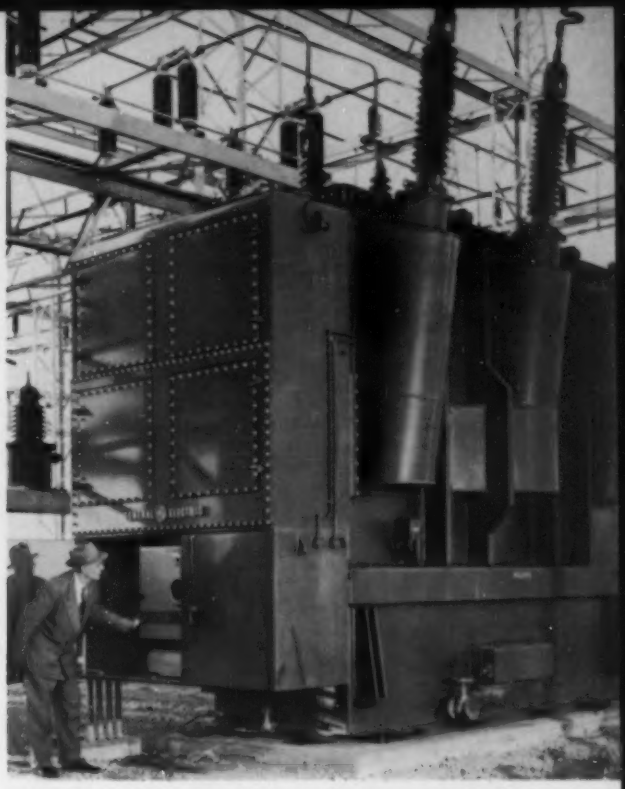
COMPLETE SWITCHYARD including structural steel was supplied as a unit through General Electric Project Services.



PERIODIC REVIEW of station design by (l to r) G. E.'s N. R. Schultz and T. O. Millard; B&V's R. C. Oliver, Jr.; IPALCO's A. J. Adams, helped solve problems, cut engineering time.



SUPERVISED INSTALLATION of equipment such as this compressor motor by G-E engineers helped assure coordination.



ON-SCHEDULE DELIVERY of this 41,667 kva power transformer, being inspected by Clarence Talsma, helped meet start-up date.

engineering time on Council Bluffs unit

Project team links apparatus details to over-all planning, frees utility and consultants for more important duties

When Iowa Power & Light and Black & Veatch selected General Electric apparatus, the G-E team assigned to the Council Bluffs project marshalled the company's vast development and manufacturing facilities. As a result, product engineering time was held to a minimum.

This team, headed by the G-E sales engineer assigned to Iowa Power & Light, was able to coordinate all electrical apparatus detail work, freeing IPALCO and B&V engineers for the project's more important phases. Many factors, such as changes in the design of one item of electrical apparatus requiring modification of other electrical equipment, were coordinated by the G-E project team.

Such teamwork, combining the utility, the consultant, and G-E's team of sales engineer, product specialists, application engineers, order service coordinators, and field service engineers, can save you time, money and man-hours. Here's how it's done:

SIMPLIFY ORDERING OF EQUIPMENT, purchased either directly, or through your consulting engineers, or through a machinery manufacturer.

CONSERVE ENGINEERING TIME by handling electrical details which frees you and your consulting engineers for other urgent problems.

INTEGRATE EQUIPMENT DESIGN to assure the maximum flexibility and effectiveness of plant operation.

SPEED CONSTRUCTION by scheduling the arrival of equipment for maximum installation efficiency.

ASSIST IN INSTALLATION AND IN TRAINING OPERATORS to assure minimum start-up time and better understanding of the full operating capabilities of the equipment.

For details contact your General Electric Apparatus Sales Representative or write Section 302-6, General Electric Company, Schenectady 5, N. Y.

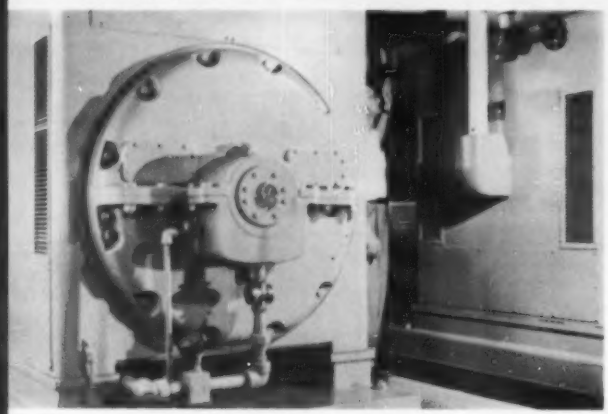
More Power to America

GENERAL ELECTRIC

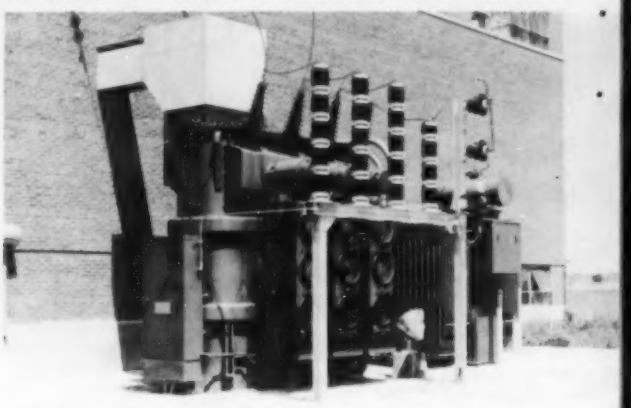
See next page for more data on Project Services ►

PROPER SELECTION of all apparatus from turbines to this G-E ash sluice pump motor is but one of many advantages of G-E project services coordination.

COORDINATED DESIGN of equipment was checked here by E. W. Springer, G. E.; F. W. Motley, B&V; F. L. Sargent, B&V; and J. T. Tengdin, G. E., Kansas City office.



SCHEDULED MANUFACTURE of these G-E boiler feed pump motors, with overhead exhaust, was closely synchronized with Council Bluffs construction progress.



ON-TIME DELIVERY of these G-E 50,000 kva main power and 5,000 kva station power transformers and the lightning arrester protection system helped eliminate costly delays.

How G-E project coordination helps keep plant construction progress abreast of schedule

From the preliminary planning stages in your project, General Electric engineers can help you and your consultants by setting up an apparatus timetable. With start-up commitments in mind, G. E. schedules the design, manufacture, and shipment dates of all electrical apparatus to coincide precisely with the time at which they will be needed at your construction site. This service helps prevent disrupting of construction schedules and sound financial planning because of early or late shipments.

Project coordination is just one of many Project Services on your job when you or your consultant specifies G-E equipment. You take advantage of all these services with G. E.:

APPLICATION ENGINEERING helps assure all electrical equipment is coordinated in design and operation to best suit the requirements of your plant.

PRODUCT DEVELOPMENT ENGINEERING means equipment design which reflects both field experience and laboratory achievements.

FIELD SERVICE ENGINEERING means supervised installation, planned start-up, proper operation of equipment.

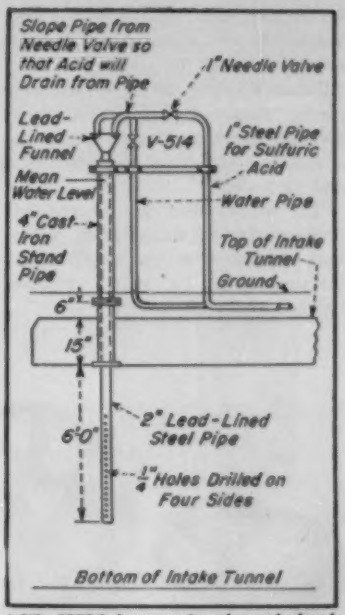
SERVICE ENGINEERING helps keep plant operating at full capability, means expert training of operators, setting up of maintenance programs.

PROJECT COORDINATION helps assure proper selection, design, manufacture, delivery of your equipment without costly delays at installation time. 302-6

More Power to America

GENERAL ELECTRIC

UNLOADING ACID is done by men wearing rubber suits and face protectors



ACID FEEDS by gravity through lead-lined funnel and pipe to tunnel carrying the cooling water to the condenser

GENERATION—Operation

Acid Added to Cooling Water Eliminates Condenser Cleaning

M. E. LUCKY, Supervisor of Production, Mississippi Power Co, Gulfport, Miss.

A sulphuric-acid feed system has been installed for treating alkaline water in the cooling towers at the 88-Mw Plant Sweatt. Mississippi Power Co has found that the treatment elminates condenser cleaning, cuts pumping costs, reduces well water consumption, and reduces the quantity of phosphate and chlorine fed to the cooling tower. Moreover, deterioration of wood in the tower should be reduced.

Installation of the system stems from the high bicarbonate content, 130 ppm, of the well water which supplies make up for the cooling towers. The pH of the circulating water ranged from 8.5 to 9.0 even with full capacity of the five wells and a concentration of only two times well water. This resulted in delignification of the redwood in the tower and a build-up of scale in condensers.

Various attempts were made during the first three years to reduce the pH to the desirable range of 7 to 7.5. Sulphuric acid from drums, at a rate of nearly a drum a day, was tried and found effective. But this was abandoned because of the high cost of acid in drums. In addition, the cost of freight exceeded cost of the acid.

Another attempt was made by burning sulphur and alowing the sulphur-dioxide vapors to go through the tower air passages. This also was abandoned because at the operating temperature of tower water insufficient vapor was dissolved. Moreover, the vapors were corroding metal parts rapidly, and sulphur pots were difficult to keep burning.

The solution adopted was the use of sulphuric acid but purchased in tankcar lots. This necessitated installation of storage, feeding, and control facilities.

The storage tank made of plain carbon steel has an 11,000-gal capacity to permit unloading an 8,000-gal tank car and still provide reserve for possible delay in delivery. An all-iron, bubble-type gauge provides remote indication without use of a dip stick. Tank cars are unloaded by applying 30-psi air pressure over the acid in the car.

Utmost care must be exercised when handling the acid because it is concentrated 66-deg Baume and can cause severe burns. During unloading workmen wear rubber suits and face protectors. A shower with quick-opening valve is provided near the storage tank. The acid cannot be diluted because it becomes corrosive to carbon steel.

Gravity feed is utilized to carry the acid from the elevated tank to the feed point. Here the acid flows through a lead-lined funnel and drop pipe into a continuous stream of water. A pH recorder is provided, and rate of feed is controlled manually. Contacts are provided on the pH meter for automatic control.

To assure reliable readings the pH recorder is checked daily with another meter, and is checked with a buffer. During the four months of operation this instrument has been found to be very reliable, requiring only minor adjustments.

If this experience continues, the system will be made automatic by adding an electrical shutoff valve, controled from the contacts on the recorder. The valve will work on a simple "on-off" control with the "on" position providing a manualy set, maximum acid feed. This control scheme appears to be the best because of the large water storage (724,000 gal) with the small acid feed rate required (¼ gal per hour).

To date the only difficulty expe-

(*Continued on page* 96)

Sulphuric Acid in Cooling Tower Water

(Continued from page 95)

rienced was the corrosion of the nickel alloy seat and plug in the feed valve. It was replaced with an all iron valve which has given no trouble. All shutoff valves are glass lined with plastic diaphragm seats and have given no trouble. This is largely because the joints were carefully made and air tested.

The acid system has proven entirely satisfactory and promises economies that will offset the $9,000 initial investment in 10 years. Benefits realized and expected are:

1. Elimination of condenser cleaning, costing $2,400 per year, with associated higher efficiency throughout the year. If scale forms, it can be removed by carefuly lowering the pH.

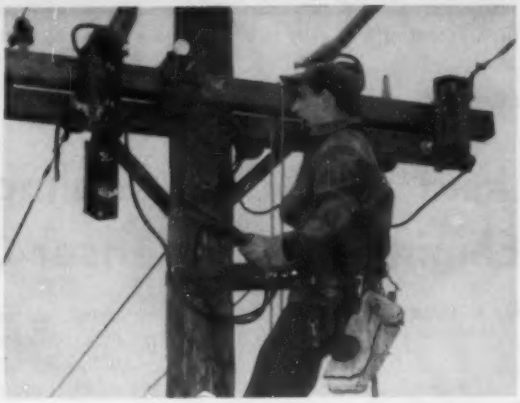
2. Reduced pumping costs. Only three wells and occasionally four are now used instead of five formerly required.

3. Reduced water consumption. Because of shortages the company felt a moral obligation to minimize water drawn from underground sources.

4. Reduced quantity of phosphate and chlorine fed to the cooling tower resulting from reduced blowdown. A concentration of four times well water is now being maintained with 7.5 pH.

5. Less deterioration of wood in the tower. This is not definite because the acid treatment has not been in service long enough for positive results.

Cost of acid is only one-quarter as much as anticipated. Acid is available as a by-product at a cost of one-third that for acid in drums. Further savings resulted because the quantity required is only one-half to three-quarters of that predicted from results of the early drum-lot trials.



Molded rubber potential transformer is used for phasing out and checking primary voltage to. . .

Assure Greater Safety for Linemen

DISTRIBUTION
Operation

J. B. MURRAY, Supt of Service Maintenance Sec, T & D Dept, Philadelphia Electric Co, Philadelphia, Pa.

A molded rubber potential transformer is being tried by Philadelphia Electric Co to assure greater safety for workmen when phasing out, checking, and measuring primary voltages, 5 kv and lower. Experience with the transformer during the past year has been very satisfactory.

Development of the molded rubber transformer stems from an accident during the use of a 2,400—120-v, 50-va potential transformer having a metal case. A troubleman was checking voltage in a switch compartment with the metal-case transformer hanging on the metal compartment door which was grounded. One of the flexible primary leads broke off and contacted the case. The resulting 2.3-kv, phase-to-ground fault tripped the circuit but the flash burned the troubleman's face and neck.

Following this accident, a crude attempt was made to partially enclose the transformer in a rubber container. This added to the size and weight and did not appear to be practical, particularly in wet weather.

So a manufacturer was contacted. The company furnished a sample transformer and specified that the new design should be rated 5-kv, have no exposed metal, have disconnecting primary leads, and be completely waterproof.

In 1953 a sample transformer was submitted for testing. It had been built to withstand the same tests given to direct-burial, molded rubber transformers, including soaking the transformer and connectors in water overnight. At the beginning and end of each soaking period a 15-kv dc, insulation resistance test is performed.

After examining the new transformer several minor design changes for more convenient field use were suggested. Then the transformer was given the following series of severe tests:

1. Dielectric strength—12,350 v, ac, 60 cps was applied between primary and secondary windings for one minute without breakdown.

2. Insulation resistance—With transformer immersed in water to within ¼ in. of terminals, primary to water measured over 1,000 megohms and secondary to water over 1,000 megohms.

3. Leakage at 10 kv, ac—With transformer immersed in water to within ¼ in. of terminals, maximum leakage

(Continued on page 104)

TRAFFIC COP FOR 400,000 KVA

Contactors, the "traffic cops" in load-tap-changing equipment, are now available for typical regulating transformers rated as high as 400,000 kva. That's a whopping increase over the previous limit of about 150,000 kva.

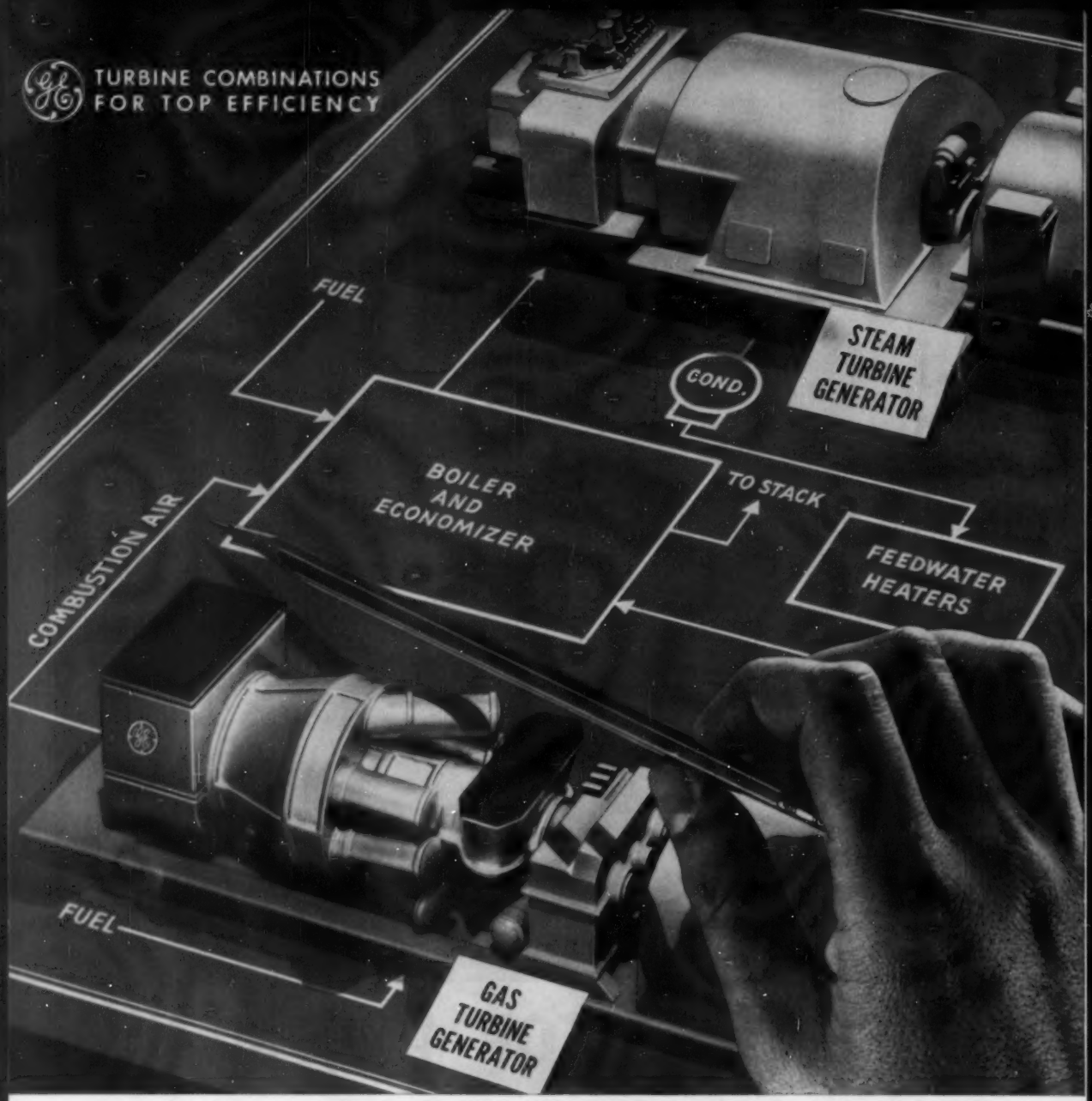
It's all due to G.E.'s new oil-blast contactor—six years in development—thoroughly tested. Even under the maximum short circuit which might be imposed at the transformer terminals, this "traffic cop" will successfully divert current from the tap selector, permitting a tap change to be completed.

Already in use on the new 194,775-kva, 138-kv regulating and phase-changing transformer recently installed by Commonwealth Edison Company, these new contactors represent a major advance in power transformer design. General Electric Co., Schenectady 5, New York. 421-36

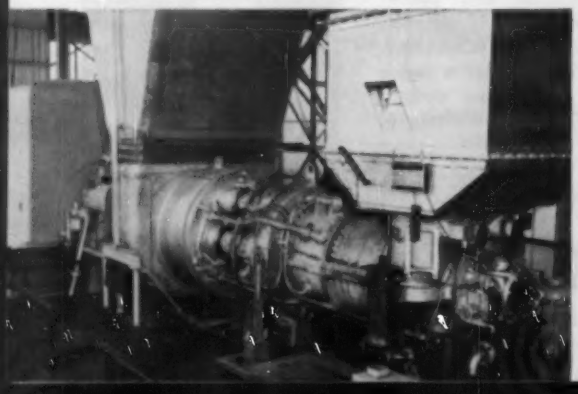
Power Transformer NEWS

Progress Is Our Most Important Product

GENERAL ELECTRIC



EXAMPLE OF GAS TURBINE used in a combined gas-steam turbine cycle is shown below installed at a Southwestern utility. Use of gas turbine exhaust for feed-water heating resulted in 15% improvement in station heat rate.



G-E GAS TURBINE PLANT shown below is devoted exclusively to the development and manufacture of commercial gas turbines. General Electric gas turbines have over 730,000 hours of operation to their credit—a world's record.

EFFICIENCY GOES UP when this G-E steam turbine-gas turbine team goes into action. Here, exhaust gas from gas turbine is used as combustion air for steam boilers. Result is 7.5% improvement in system efficiency.

NEW WAY TO IMPROVE HEAT RATE:

G-E gas turbine exhaust used as boiler combustion air

When combined with a steam turbine in a generating plant, the G-E gas turbine can make a significant contribution towards over-all electric generating station efficiency and resulting economy.

IN THE EXAMPLE AT LEFT, exhaust gas from the G-E gas turbine, which retains over 80% of its original oxygen, is used as preheated combustion air for fuel-fired steam boilers. The gas turbine itself drives a generator in parallel with the main turbine-generator.

TAKE A 6000-KW GAS TURBINE, for example. It provides all the combustion air required for a boiler supplying 1250-psig, 950 F steam for a 40,000-kw condensing steam turbine. Net heat rate for such a plant would be 10,760 Btu/kwh as contrasted to 11,630 Btu/kwh for a steam plant without a gas turbine. The improvement is 7.5 per cent.

IN DOLLARS AND CENTS, that represents a $60,000 per year saving as a result of using a gas-steam turbine cycle (based on 70% plant factor, 15% gross fixed charges, and 25¢/million Btu for fuel).

SIMILAR ECONOMIES ARE obtainable with other gas-steam turbine cycles. For details on the arrangement most useful to you, contact your G-E Apparatus Sales Representative, or write for Bulletin GER-1026. Address Section 261-5, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Maintenance of Outdoor Circuit Breakers

A suggested program is outlined for regularly scheduled thorough maintenance inspection of outdoor power circuit breakers

R. O. BONINE, Switchgear Division, Westinghouse Electric Corp, East Pittsburgh, Pa.

In planning a maintenance program of thorough inspections for current breakers:

1. Use an itemized check list of all items and adjustments to be checked.

2. Maintain a record file on individual breakers, consisting of instruction books, drawing, timing, test, and adjustment records.

After initial installation make maintenance inspections as follows:

Patrol inspection of all breakers each week to one month; external inspection of 69 kv and lower every four months; complete inspection of 69 kv and lower once a year; external inspection of 115 kv and above every six months; complete inspections of 115 kv and above six months after installation, 18 months after installation, then every two years.

The above recommended inspection frequency should be used as a guide only. A breaker subjected to a large number of operations, excessive interrupting duty or any unusual condition found on routine inspection should receive special consideration and therefore more frequent inspection.

During complete maintenance inspections:

1. Practice safety: Obtain clearance, ground the bushings, and tag all circuits.

2. Close breaker by power before oil is drained or tanks are lowered in order to obtain contact compression check after power close.

Inspection program should include thorough inspection of following circuit breaker components:

A. Operating Mechanism—Solenoid and Pneumatic

1. Clean thoroughly.
2. Relubricate all pins and bearings.
3. Check trigger and latch surfaces for oxidation, lubrication, engagement, and spring tension.
4. Check all hardware for tightness, broken lock washers, and broken or missing cotter pins.
5. Check auxiliary switch operating levers, contacts, wiring connections and adjustments.
6. Inspect relays, contactors, switches, and fuses for clean, tight contacts, freedom of operation and proper operation.
7. Use SAE-30 engine oil to lubricate pins and bearings not dismantled.
8. Use graphite lubricant on bearings, pins removed for cleaning, latches, triggers, valve parts, pistons, rings, etc.
9. Use very light oil on piston shaft packing glands.
10. Check space heaters and thermostat.

B. Air Supply System

1. Drain condensate from air storage tank.
2. Drain oil from compressor crankcase, clean, refill with new SAE-20 oil for normal climates and SAE-20W for extreme cold areas.
3. Check operation of compressor, valves, belt tension, safety valves, pumping time; lubricate motor bearings if open sleeve-type are used.
4. Clean air filter.
5. Check operation of all pressure switches.
6. Check for leaks in air system and repair if necessary.

C. Condenser Bushings

1. Clean thoroughly.
2. Make power factor test during installation and then again after one year's service, then every two years except where test results have been obtained showing power factor values near the allowable limits, or appreciably higher values than those obtained in previous tests.

D. Insulation Material

1. Clean thoroughly.
2. Check for cracked material, carbon deposits, electrical treeing, loose rod ends, warped material, signs of moisture and condition of varnish.

E. Circuit Breaker Contacts

1. Check stationary and moving contacts for proper alignment, compression, resistance, contact-tip peening, cracking, deformation and excessive burning. If contacts are dressed by filing, remove projecting burrs only. Do not file to remove pitting.
2. Check all pistons, rods, and bearings for freedom of operation.
3. Check all shunts and current-carrying joints for cleanliness and tightness.
4. Clean carbon from grid stacks without dismantling.
5. Check assembly tie rods for tightness and check that none are broken.
6. Check fiber plates for excessive warpage. Be sure all adjustments are in order, properly tightened and securely locked.

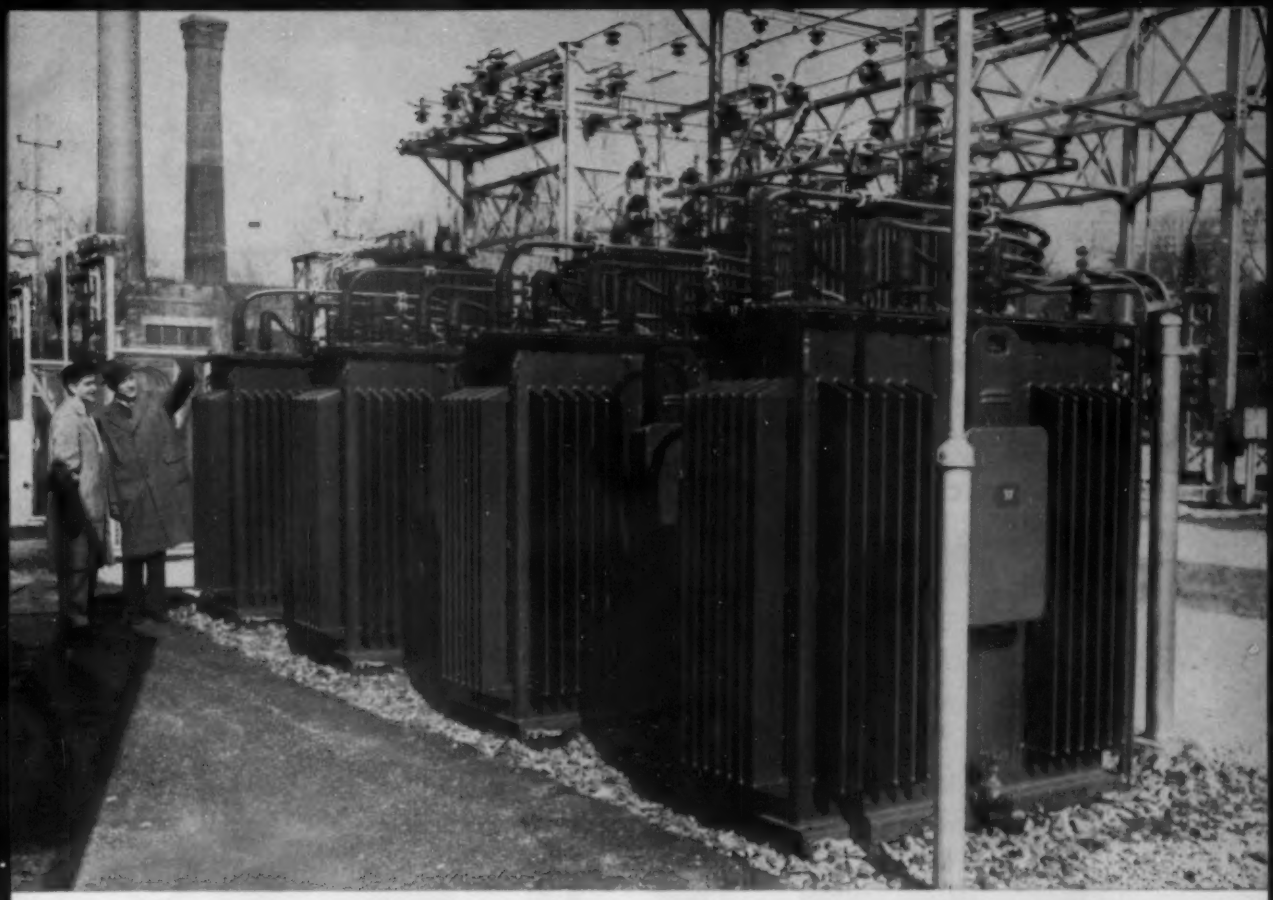
F. Mechanical Adjustments

1. Check pole unit lever systems for proper travel, freedom of operation and satisfactory manual closing and opening.
2. Check operation of hydraulic shock absorbers, lift rod and toggle stop settings. Unless stops are found to be loose or removed it can be assumed that the lever system is in the proper position when closed within $\frac{1}{8}$ in. of stops.
3. See that all cotters and hardware are in place and tight.
4. Check and relubricate all bell-crank and operating levers.

G. Maintenance Operating Test

1. After the inspection has been completed and the breaker tanks filled with clean oil testing 25-kv or better, operate the breaker manually and electrically.
2. Check tripping at reduced voltage and sneak trip test slowly by hand.
3. Check mechanically trip-free mechanism for retrieving when released slowly by hand.
4. Possibly make timing tests but usually they are not considered necessary unless adjustments are made or new parts installed.
5. Keep thorough records including inspection reports, test results, travel records, drawings and manufacturer's instruction books.

Periodic visual patrol inspections and frequent external inspections for all power circuit breakers, also specific inspections for indoor oil-type and compressed-air oilless circuit breakers were outlined in Engineering Reference Sheet No. 55-16.



G.E.'s 3-phase induction voltage regulators give dependable service at Philadelphia Electric Company's Overbrook Substation.

FOR LOWER OPERATING COSTS . . .

G-E 3-phase, triplex, induction regulators save space and reduce maintenance expense

Overbrook is one of Philadelphia Electric Company's substations in an outlying residential and industrial area. Originally a two-phase station, it now serves this area with nominal 4000-volt, three-phase, 300-amp feeders. The new feeders are provided with three-phase induction voltage regulators for ±10 per cent regulation.

Lowered cost of maintenance, as well as rapid voltage response to the varying demands of the important loads they serve, is inherent in these units. In addition, space was saved at Overbrook by using induction-type units, eight of which are installed at this station. Each of these was readily fitted into the position formerly occupied by two single-phase, induction-type, feeder voltage regulators on the old two-phase feeders.

You, too, will find General Electric's three-phase, triplex, induction regulators excellent for the closest regulation of your feeders.

They are especially useful where voltage swings require immediate correction and operations are frequent.

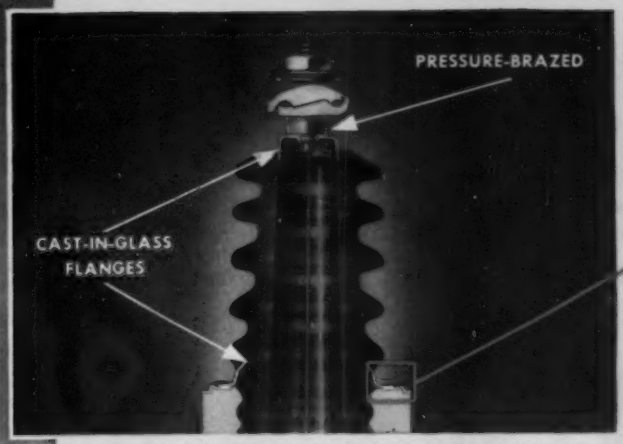
Their sturdy, long-lived operating mechanism—with no switching contacts—requires no maintenance. This elimination of routine internal maintenance results in lower servicing costs.

For more information, get in touch with your nearest G-E Apparatus Sales Representative or write: General Electric Co., Schenectady 5, New York. 434

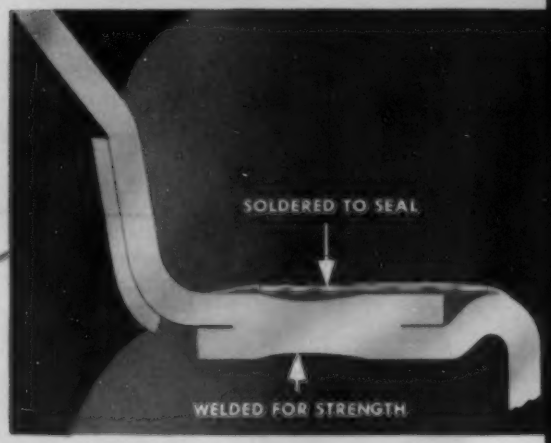
Progress Is Our Most Important Product

GENERAL ELECTRIC

Engineered
Extras
at no extra cost
641 POUNDS, enough to bend the channel bar, doesn't harm these sturdy, welded and soldered G-E capacitor bushings.



CROSS SECTION OF G-E CAPACITOR BUSHING shows unique pressure-brazed terminal connection and cast-in-glass flanges.



SIX SPOT WELDS around circumference of mounting flange plus soldering provide maximum strength and perfect hermetic seal.

G-E CAPACITOR BUSHINGS SUPPORT OVER 600 POUNDS!

Dramatic new test proves strength of unique welded and soldered, cast-in-glass construction

You can safely lift G-E capacitors by their bushings . . . we do it ourselves. And, they're built to withstand this treatment without cracking the perfect hermetic seal or having the bushings pull out of the case.

EXTRA-STRENGTH BUSHINGS mean General Electric Capacitors are made to last throughout years of all-weather, all-temperature service. This superior strength is produced by the unique G-E cast-in-glass bushing construction that provides metal-to-metal contact in which the bushings are first welded and then soldered to the capacitor case.

EXTRA QUALITY is engineered into all parts of G-E capacitors: ***Case***, a machine-controlled resistance weld around the center flange—only half as long as the arc-welded seam on other capacitors; ***Bushing Terminal***, a new solid-stud terminal with stainless steel Belleville washers that exert 1000 pounds contact pressure on either one or two copper or aluminum conductors; and ***Size*** and ***Weight***, G-E capacitors are smallest and lightest.

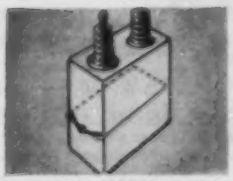
These are but a few of the ***Engineered Extras*** found only in General Electric capacitors, that make them highest quality, and, your best value. General Electric Co., Schenectady 5, N. Y. 440-18

Progress Is Our Most Important Product

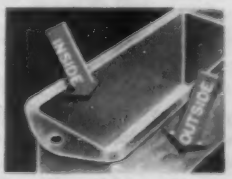
GENERAL ELECTRIC

ONLY G-E CAPACITORS HAVE ALL THESE

Engineered Extras



SHORTEST WELD LENGTH, only half as long as on other makes of capacitors.



CASE TIN-PLATED inside and outside, for better protection against corrosion.

SMALLER AND LIGHTER than any other make, for easiest handling and installation.

NEW TERMINAL ASSEMBLY with Belleville washers gives lasting contact pressure.

Molded Potential Transformer

(*Continued from page* 96)

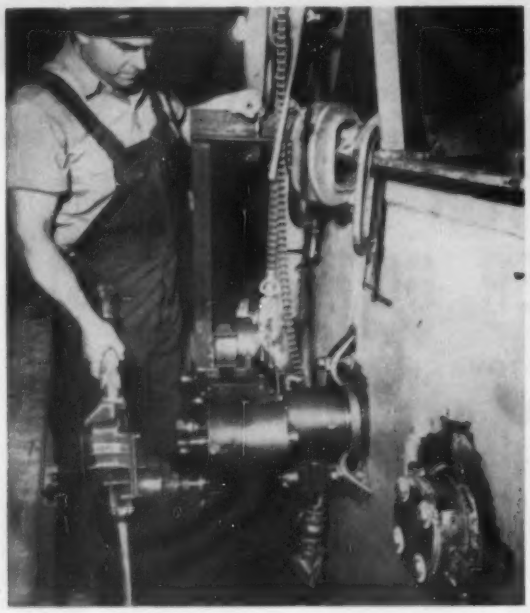
of primary to water measured 2.3 ma and of secondary to water 2.1 ma.

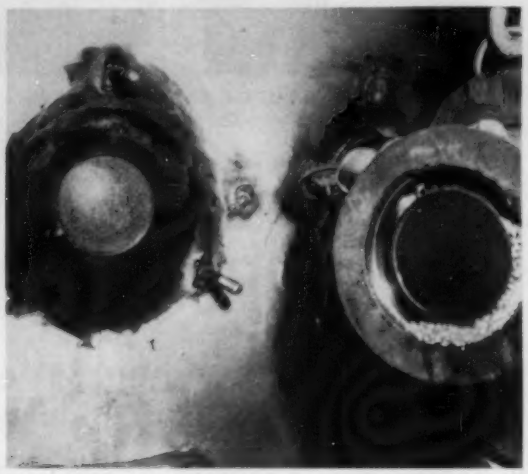
4. Simulated rain at 10 kv, ac—With water spray applied until transformer was totally immersed, maximum leakage measured 2.5 ma at start and 3.2 ma immersed.

5. Simulated hot weather—Transformer was placed in atmosphere of 150 F for four hours and Test No. 4 was repeated. With transformer removed from the heat, maximum leakage measured 2.4 and 3.1 ma.

6. Destruction—Ac voltage impressed between primary and secondary windings was increased to 17.5 kv before failure.

These test results indicated that the molded rubber transformer would be highly satisfactory for outdoor use in wet weather, so a number were purchased for use by trouble-men and line crews. If their performance continues to be as satisfactory as indicated thus far, the company intends to replace all metal-case potential transformers with the molded rubber type.





DRILL FACE was held against tank by dogs screwed onto bolts. Corprene gasket inside tank prevented loss of oil

SPECIAL DRILL cut 36 holes in oil-filled transformer with a loss of 2 gal of oil. Each cut required approximately 8 min

DISTRIBUTION—Maintenance

Special Drill Cuts Holes into Transformer Tank

Use of a special drill in the installation of radiators on an oil-filled transformer saved a 52-mile trip for untanking and draining of oil. In the operation at Portland General Electric Co's Station H, only about 2 gal of oil were lost from the 4,400-gal tank during the cutting of 36 holes each 4⅜ in. in diam.

Cutting into the tank was the first step in installing 18 cooling fins on the unit. The special drill consisted of a cutter arbor made of shelby tubing welded to a mild steel hub. High-speed tool bits were brazed onto the cutting surface. The arbor was driven about 18 rpm through a double-reduction gear by an air-powered drill.

Power feed was made with the lead screw threaded into the outer end of the cutter arbor. Feed screw and arbor were both driven by a common pinion to a 79-tooth gear on the five-thread screw and an 80-tooth gear on the arbor. This gearing advanced the feed screw gear one tooth each revolution of the cutter and provided a smooth, positive feed. Rate of feed was 0.003 in. per revolution of the cutter. A cut through the 0.4375-in. tank wall was made in about 8 min.

The gasketed face of the drill was held against the tank wall with three dogs that were tightened with bolts welded to the tank. Two face plates were used—one for flat surfaces, the other for curved. These plates were threaded to the body of the tool.

Transil oil for cooling was circulated through the cutter by a small pump. Just before the cutter broke through the tank wall, the pump was shut down. As the break occurred, oil from the tank flowed out through the cutter and kept small metal particles from falling into the transformer.

After each cut was made, a 0.250-in. thick corprene gasket was placed over the hole on the inside of the tank. This held back the transformer oil while the tool was removed and a valve body welded in place. The gasket, attached to a long stick, was slid down inside the tank until it covered the hole.

On holes near the bottom of the tank, oil pressure against the gasket was sufficient to maintain an oiltight seal. On holes near the top where pressure was lower, the gasket was clamped by a lever to the top tank flange.

(*More How To on page* 106)

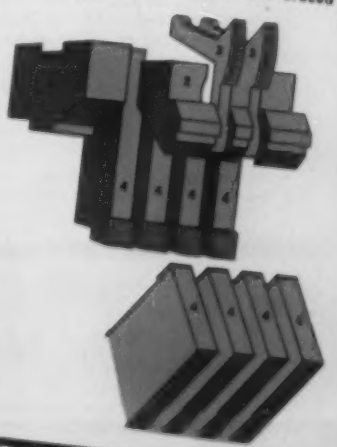
G-E Type AK-1-50 Electrically Operated Air Circuit Breaker, 1600-amperes, 600 Volts, A-C. One pole shown. Made by General Electric Company, Low Voltage Switchgear Department, 6901 Elmwood Ave., Philadelphia, Pa.

Here is the General Electric Type AK-1-50 Electrically Operated Air Circuit Breaker, 1600-ampere frame size used to protect low-voltage systems. The picture shows one pole of the contact, and in order to photograph it, the housing and the arc-quencher parts were removed. Note the Revere Extruded Shapes, and Rectangular Rod. There are three shapes, and one size of bar, all in copper, because copper has the highest electrical conductivity of all commercial metals.

If these shapes had to be "hogged" out of bar, they would be expensive, due to the machining time, and the scrap generated. While copper scrap is readily salable at good prices, it is costly from the machining standpoint. Extruded shapes by Revere, preformed to the desired contours, usually reduce machining to a cutting-off operation, plus such minor details as drilling which cannot be done during extrusion. Shapes naturally cost more per pound than bar or rod, but the ultimate saving makes up for the difference and more, sometimes several times.

Are you doing much machining of copper? If so, look into Revere Extruded Shapes. They may save money, and speed up production as well. See the nearest Revere Sales Office.

Sketch showing details of contacts. Nos. 1, 2 and 3 are extruded and drawn copper shapes. No. 4 is rectangular copper bar. Cross hatching represents special arcing contacts brazed to the copper.



REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

* * *

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. —Sales Offices in Principal Cities, Distributors Everywhere

THESE GREASED GRIPPING CHUCKS

HOLD

STEEL STRAND AND ACSR IN RELIABLE SPLICES AND DEADENDS

Single jaw for 3/8" steel strand has 165 teeth.
Cutaway showing complete gripping chuck assembly. Here's how floating jaws surround and HOLD conductor.
Single jaw showing two-level design for ACSR.

Extensive research has shown the way to make self-acting splices and deadends to HOLD even steel strand. These same basic principles are now applied to all other Reliable gripping chucks made to HOLD ACSR, copper and aluminum.

Look at the illustration of the jaw for 3/8" steel strand. Note the number of sharp teeth. This size chuck has 495 individual teeth that engage the wire instantaneously and HOLD permanently. Made in six sizes for No. 8 wire to 7/16" strand. They even HOLD such high tensile steels as are used in prestressed concrete construction (260,000 to 290,000 P.S.I.)

The second jaw above is for No. 2 ACSR and features the two-level design that permits the steel core and the aluminum conductor to be gripped and HELD by the same chuck. In this size a total of 84 individual teeth grip the steel core and 396 more surround and HOLD the aluminum strands.

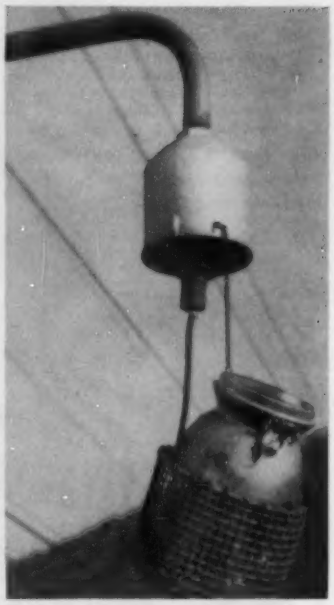
The gripping chucks, used in Reliable splices and deadends, are designed and made to HOLD permanently. Tension applied momentarily, during installation, assures an electrical joint that is of less resistance than the conductor.

A momentary tension of about 15% of rated wire strength is enough to produce and maintain this low resistance joint.

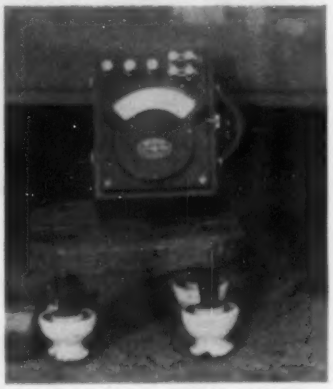
Reliable ELECTRIC COMPANY
3143 Carroll Avenue
Chicago 12, Ill.

Over 45 years service to the utilities

POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES



Mogul-base adapter connects to . . .



Ammeter on insulated stool for . . .

Checking Series Circuits Safely Without Linemen

G. H. BROYLES, Appalachian Electric Power Co, Roanoke, Va.

An adapter has been devised in the Roanoke Division of Appalachian Electric Power Co to safely and accurately check the current in series street-lighting circuits so lamp life is prolonged. Use of the adapter that fits into a mogul-base socket eliminates the need for two linemen to cut an ammeter into the circuit, thereby making them available for regular duties.

Costing $4 for labor and material, the adapter consists of appropriate

heavy-duty, male and female plugs for connecting the mogul socket to 25 ft of 5-kv, two-conductor, No. 10, flexible cable. The other end of the cable is connected to an ammeter that is insulated from ground with a stool having 5-kv insulators for feet.

In operation, a maintenance man—not a lineman—attaches the adapter to a lamp socket while the street-light circuit is dead. He then energizes the circuit at the control point and makes the test safely.

This procedure is used every time a constant-current transformer is moved to a new location, when units that have had coil changes are installed, and when supply-station voltage is increased. It is applicable to both small and large districts.

DISTRIBUTION—Construction

Small Instrument Locates Hidden Metal In Walls

A portable instrument for locating and tracing hidden metals in walls of buildings has been developed by a Florida air-conditioning installation company. The instrument will detect both electric wires and steel items, thus eliminating the possibility of finding obstructions when a hole is cut in a concrete or wood wall for the air conditioner.

The instrument consists of a metal box, about the size of a cigar box, and a detachable antenna. Inside of the box is an assortment of tubes and condensers, a speaker, and a 67½-v "B"

(*Continued on next page*)

THESE GREASED GRIPPING CHUCKS

HOLD

COPPER AND ALUMINUM CONDUCTOR IN RELIABLE SPLICES AND DEADENDS

Literally hundreds of teeth grip and HOLD the copper conductor.
Conductor is almost completely surrounded by the Reliable gripping chuck assuring an overall permanent grip.
Jaw used in Reliable deadends to HOLD aluminum strand or solid wire.

In developing gripping chuck jaws that HOLD high tensile steel strand, Reliable researchers developed new jaw designs that grip and HOLD permanently not only steel strand and ACSR, but also copper and aluminum. These designs are now used in all Reliable splice and deadend gripping chucks.

On each copper gripping chuck jaw for 2/0 copper conductor, there are 126 cold-forged engaging teeth or a total of 378 individual HOLDING points in each three-jaw chuck. The teeth, the chucks and the precision tapered cases are scientifically designed and precision made to HOLD permanently.

The aluminum jaw illustrated above is for No. 2-7 str. aluminum. The three-jaw gripping chuck is provided with 315 individual, keen-edged teeth that grip the strand instantaneously and HOLD permanently without damage to the strands.

A tight, low-resistance electrical joint is assured with Reliable splices when momentary tension is applied at time of installation. Reliable splices properly installed will actually run cooler than the conductors.

A momentary tension of about 15% of rated wire strength is enough to produce and maintain this low resistance joint.

Reliable ELECTRIC COMPANY 3145 Carroll Avenue Chicago 12, Ill.

Over 45 years service to the utilities

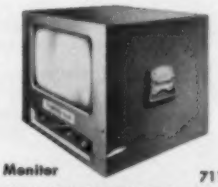
POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

USE DIAMOND UtiliVue
INDUSTRIAL TELEVISION SYSTEM

Everyone can see those tall chimneys that carry off gases or fumes from your plant. Many of these people will judge unfairly . . . will blame you for everything from smog to tattle-tale grey wash . . . even though there is smoke for only a few minutes a day.

The "UtiliVue" (wired television) will bring a sharp picture of the stacks to the control panel or any other convenient point. The operator SEES the smoke exactly as do people on the outside and takes corrective action at once. Chimney smoke is only one of many things that the "UtiliVue" can watch to your profit and advantage . . . in fact, anything that is too remote, too hot, or too dangerous to observe directly. Get in touch with your Graybar Distributor or use the coupon below for informative booklet.

UtiliVue Camera


Monitor

7119

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ELECTRONICS DEPT., P.O. BOX 415AA
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Please send me without obligation a copy of new bulletin showing how Diamond Industrial (Wired) Television will help me reduce costs, improve quality, increase sales and aid safety.

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Company_____
Address_____

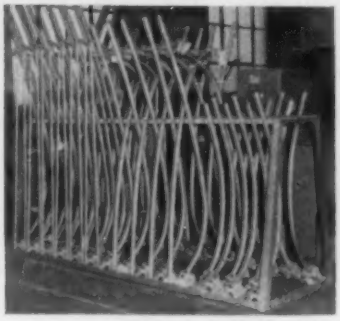
Hidden Metal Finder

(Continued from previous page)

battery. A trigger-spring switch protrudes from the bottom of the box. The antenna is merely a piece of fiber with strands of copper wire glued around the outside border.

A whirling sound is emitted from the speaker, in the bottom of the box, when the switch is closed. This indicates an absence of metal. However, when a metal object is in front of the antenna, the sound is reduced in volume; and if the metal object is large, no sound is emitted.

DISTRIBUTION—Maintenance



Street-Light Bracket Rack Saves Time and Space

E. STEWART, Stores Dept, Kentucky Power Co, Ashland, Ky.

A rack for upsweep street-light brackets has been made by Kentucky Power Co to solve storage and auditing problems. The rack accommodates 56 brackets, 4 to 8-ft long, in a floor space of 3x10 ft, instead of several times this area formerly required when brackets were stored in piles.

Constructed at a material cost of $21 and with 16 manhours, the rack is 10 ft long by 4 ft high and tapers from 3 ft at the base to 20 in. at top. The frame consists of pieces of 2x2x½-in. angle iron, welded together, with two, 10-ft long, 2x10-in. slotted planks bolted to the top of the assembly.

Use of the rack saves time when inventorying or reordering brackets because a glance reveals the number of each size available, without moving brackets. Space is provided at the top and bottom for storing accessories, such as clamps, street ells, and braces.

ROECLAD PORTABLE POWER CABLES

TYPE G ROECLAD CABLE – with ground wires – for service to 5000 volts.

TYPE W ROECLAD CABLE – without ground wires – for service to 2500 volts.

TYPE SH-A, B, C or D ROECLAD CABLE – shielded, with or without ground wires – for voltages above 2500 – made in four different applications of shielding and ground wires.

YOU WANT

- RUGGEDNESS – FOR MAXIMUM LIFE IN TRANSMITTING POWER TO MOBILE EQUIPMENT UNDER TOUGHEST CONDITIONS;
- CABLES THAT ARE TAILOR-MADE FOR YOUR OWN PARTICULAR REQUIREMENTS;

IN SHORT,

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Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 12235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, 1723 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

Fireproof Vault Wins Decision by Economy

- Copper savings hit 50%
- Power losses drop
- Voltage regulation improves

L. J. LANGEVIN, Power Engineer, Cincinnati Gas & Electric Co, Cincinnati, Ohio

A fireproof transformer vault in Liebel Flarsheim's new plant at Reading, Ohio, now supplies 1,000 kva to feed the building's lighting, motor, welding, and X-ray load.

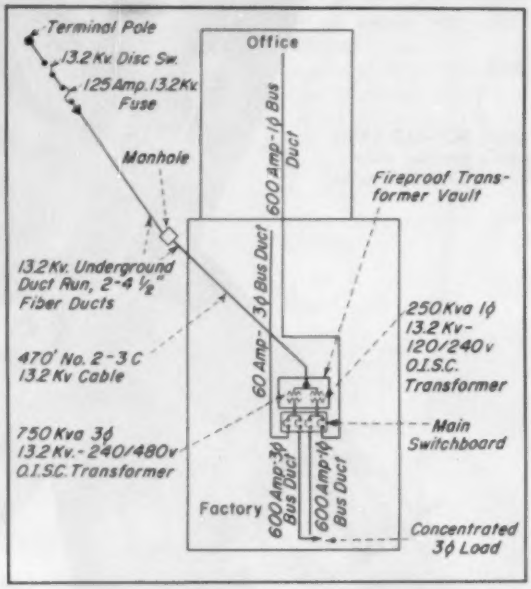
An outdoor substation was contemplated at first, but the idea was scrapped in favor of putting the transformers near the load center. Resulting economies would include:

- Halving the length of bus ducts needed to carry the power. In addition to saving materials, this reduced feeder voltage drop and improved voltage regulation.
- Two bus ducts of half the size and length could be used instead of a single bus duct of twice the size and length. This meant a 50% copper saving.
- The increased cost of the fireproof vault was more than offset by the economy of copper and improved voltage conditions. Furthermore, the vault walls could be used to help support a cooling tower above it.

The vault is served by a 13.2-kv, three-phase underground line which runs from a nearby overhead terminal pole. Energized by a gang-operated fused disconnecting switch, the 180-ft line consists of two 4½-in. fiber ducts and one No. 2 three-conductor, 15-kv, lead-covered cable. The cable runs to a pull box, then continues 260 ft in a different direction, ending in the transformer vault. Thirty extra feet were provided for connections.

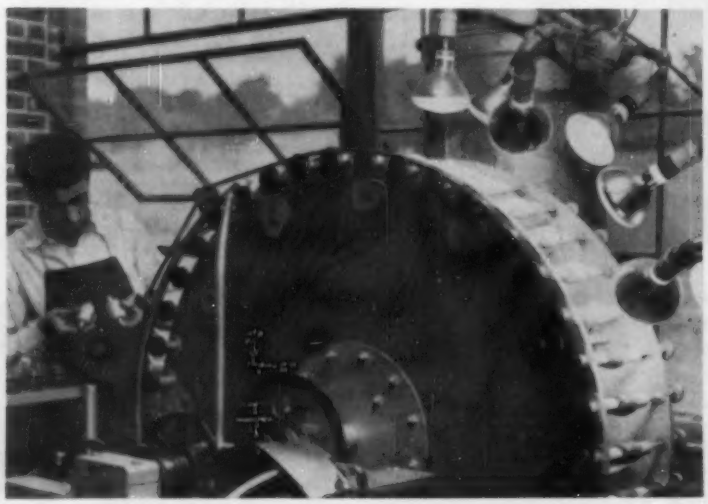
It feeds a 750-kva, three-phase 13,200/240-480 O.I.S.C. transformer, and a 250-kva, three-phase, 13,200/120-240 O.I.S.C. transformer. The larger transformer supplies 550 hp of motors, and 550 kva of single phase welding and X-ray equipment. The smaller transformer supplies the 225-kw lighting and small motor load.

The main switchboard is on an outside wall of the vault. From this point, the power and light bus ducts run in opposite directions. The inside of the vault is ventilated "naturally" by a vertical duct to the roof.



UNDERGROUND CABLE feeds Liebel Flarsheim's new fireproof transformer vault at 13.2 kv for lights and machine

INDUSTRIAL—Operation



Infra Joins Robot; Production Spurts

ROBERT ENKELMANN, Industrial Engineer, Union Electric Co of Missouri, St. Louis

Seven 375-w infrared lamps are beaming on a slow-moving wheel in Jefferson Product Co's Washington, Mo., plant, while small parts get two coats of sprayed-on paint. This combination of heat and robot has turned out as many as 400 parts an hour.

Nozzles spray out the paint at the "bottom" of the wheel. Primer coat is dry when parts get back to sprayers. Cams automatically switch nozzles from "primer" to "finish" and the infrareds finish the job.

(*More Industrials on page* 115)

HOW WILL THEY WORK TOGETHER?

Insulators and Hardware should be "Made For Each Other"

Small wonder, we feel, that the builders of this 330-kv line chose Ohio Brass clamps and rings (and insulators, too) for extra-high voltage use. Small wonder, we say, for O-B makes both insulators and hardware; we can assure the user that O-B combinations will perform properly.

In this respect, we are unique among manufacturers of such materials. We believe good insulation is a *combination* of both insulators and hardware. Our laboratory and factory processes are guided by the question, "How will they work together?"

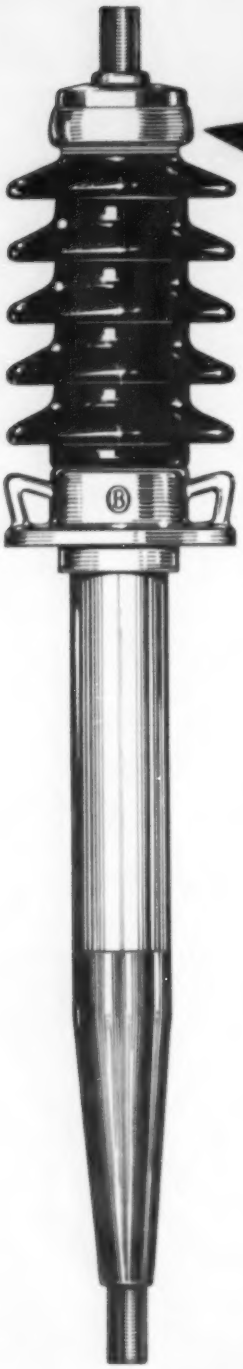
Concern and responsibility for the insulator-hardware combination has been a worthwhile attitude for Ohio Brass Company -- more than two-thirds of the EHV circuit miles in North America are hung on O-B! And, experience shows that that same concern has always paid off for our users in superb service records!

Ask your O-B representative about the value of coordinated insulators and hardware for your lines!

OHIO BRASS COMPANY, MANSFIELD, OHIO

In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

Ohio Brass



SPRING COMPRESSION ASSEMBLY ASSURES PERMANENT GASKET JOINT EFFICIENCY IN NEW O-B BUSHINGS

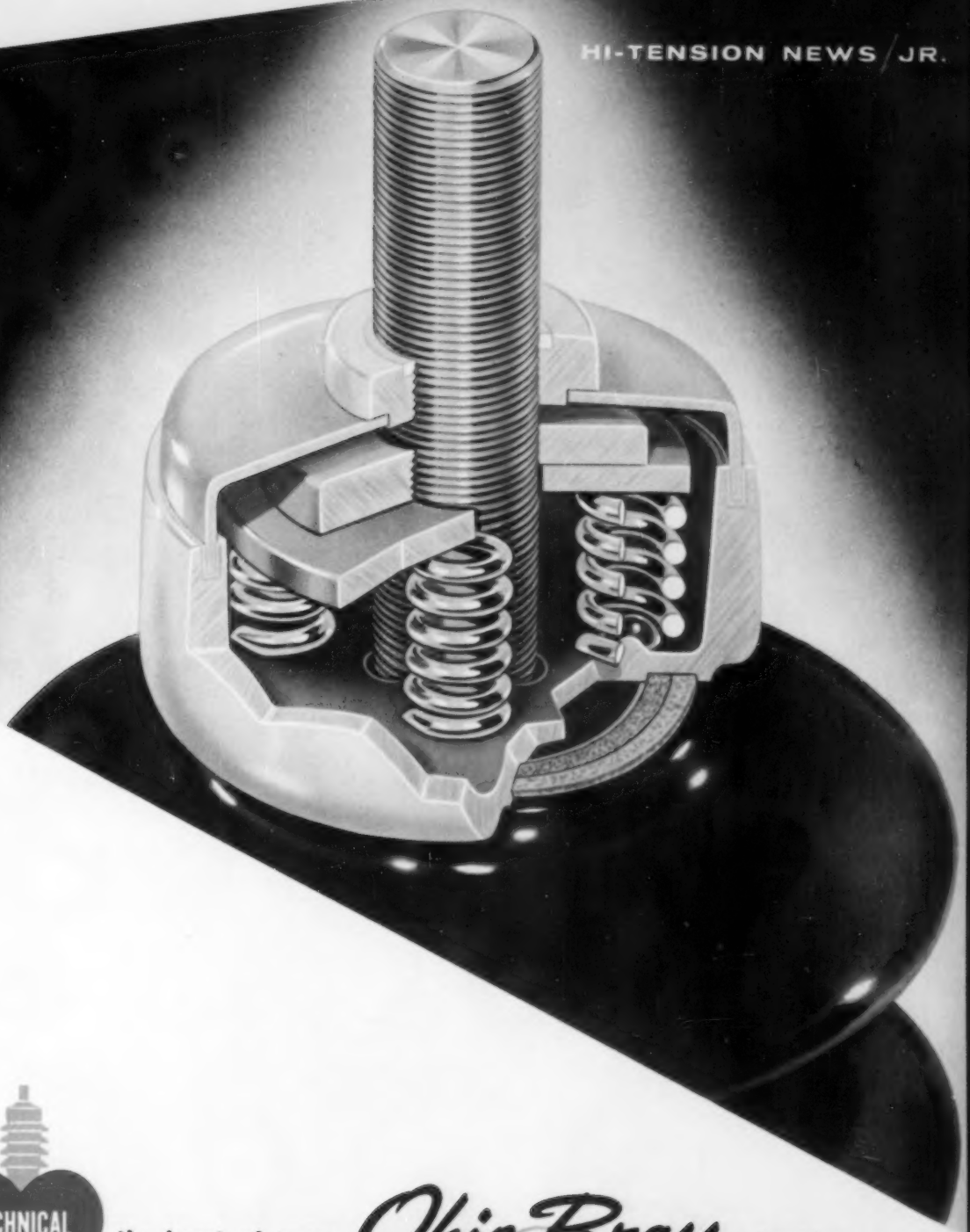
. . . Another Extra, Beyond ASA Standards, that accounts for high reliability and high value . . .

Proper performance of sealing gaskets in a bushing depends upon two factors: (A) A definite compressive force. (B) Maintenance of this force despite slight dimensional changes caused by expansion and contraction movements, and by any loss of original gasket volume.

This is not a new discovery. Over 30 years ago, O-B pioneered in a bushing assembly method that has since been almost universally adopted -- spring compression assembly. Long ago, this worked a vast improvement in bushing performance and reliability. With today's more critical new designs to produce the slim, efficient ASA Standard, O-B's long-proved compression spring assembly practice takes on added importance. Modern bushings, which depend upon the integrity of paper dielectric, must be protected with a total oil and moisture seal.

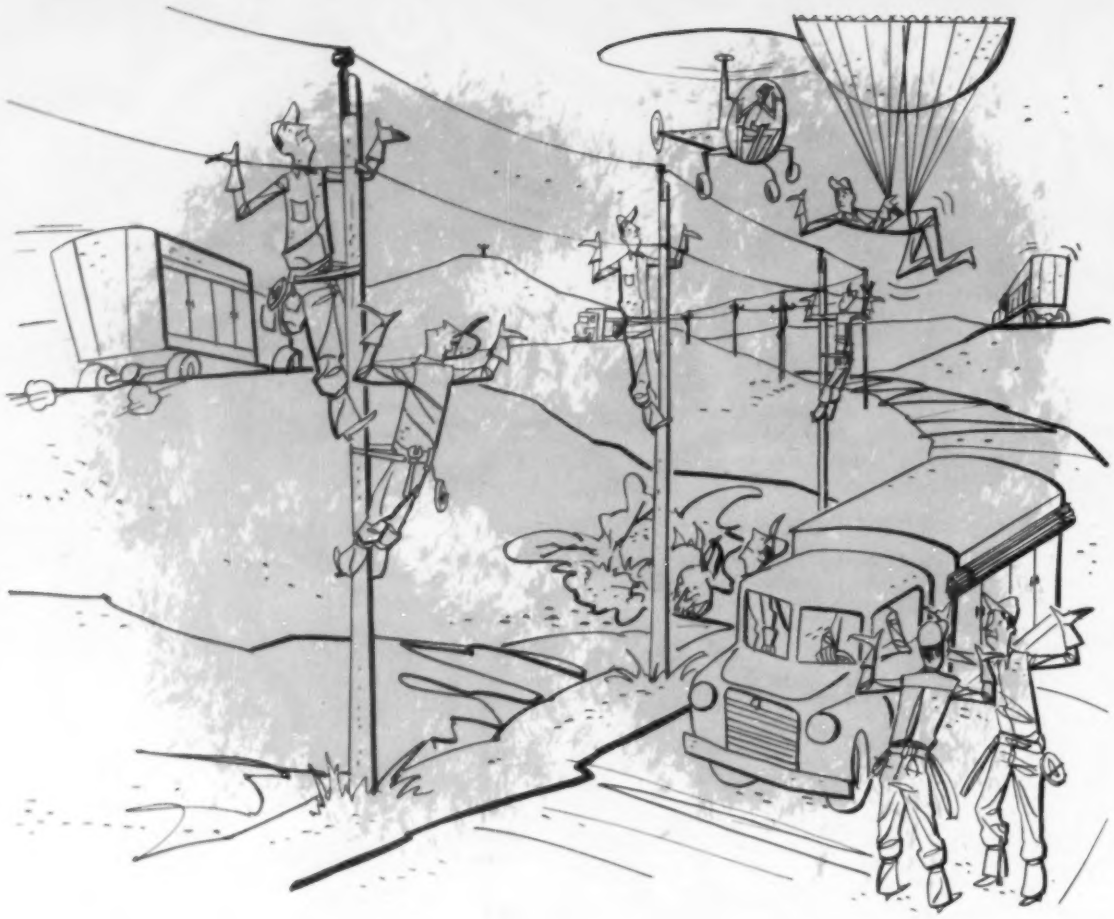
At time of assembly, a simple jig measures and sets the force exerted by the compression spring mechanism. Special parts retain this setting for the bushing's life. Over the slight amplitude of expected movement, this compression never varies. Gasket loading is measured, controlled, and un-changing, even after any volume loss.

Spring compression assembly and dependable sealing practices *are in no way covered by national standards.* This is just one of many extra touches of quality, and one of many extra reasons for performance, you will find in O-B's new bushings. Specify O-B on your station equipment and put all these extras to work for you.



TECHNICAL COMPETENCE

the heart of every *Ohio Brass* bushing



Want a better way to handle lightning outages?

Could be you have enough man-power on hand to be able to locate and service an outage in half an hour or less. Could be, but we doubt it. Line crews just aren't that large! Even so, you know that the number of man-hours needed to fix a rural outage can be astronomical.

The better way (best, in fact) is to insulate your unprotected rural lines with pintypes of proved puncture immunity. O-B pintypes are the only insulators on the market today backed by laboratory confirmation of their puncture-proof quality.

Your Graybar salesman has proof of this lightning immunity in O-B insulators. Have him show you why you'll stop lightning outages when you insulate with O-B!

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

GraybaR Distributed by GraybaR ELECTRIC COMPANY

4537-

Output Jumps Through Oven's 'Hoop'

- **Overhead kiln releases floor space**
- **Permits continuous enamel-baking**

C. J. SODERGREN, Industrial Power Representative, Baltimore Gas & Electric Co,* Baltimore, Md.

An overhead 450-kw electric oven is holding an economic "hoop" for Black & Decker Mfg. Co., Hampstead, Md., and production rates are jumping.

An overhead conveyor carries the freshly enameled portable electric tool and sheet-metal parts through the baking chamber on a "process" basis. The conveyor loops back and forth inside the oven, and baking time is controlled by adjusting the conveyor's speed.

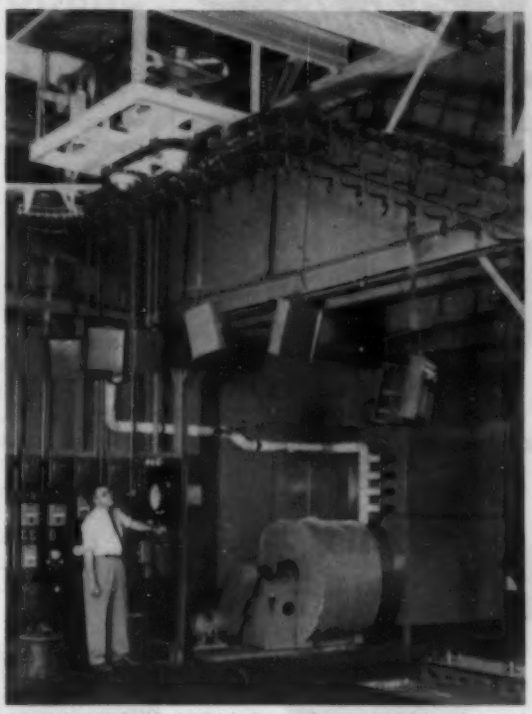
The entire system contains about 900 ft of chain conveyor with a range of speeds of 4 to 14 fpm. Installation of this equipment has increased production about 2½ times over previous levels.

About 1,100 sq ft of production space has been created on the floor level of the company's enlarged plant due to overhead mounting of this oven. There is 12 ft of headroom below it.

Open ribbon elements on insulated spools can raise the oven's temperature to 500F, although normal operating temperature now is around 300F. Engineers specified the extra heat capacity after taking a look into the future.

This oven is particularly well-insulated. Despite its operating temperature, little heat "leaks" to the working area around it. Air circulates through the baking chamber to the heaters, which are in a separate compartment, to eliminate hot or cold spots.

Electric heat also bakes varnished field coils and stators of motors for the company. At first, one oven carried the load entirely. But results were so excellent that a similar unit has been added to match the growing work volume. These ovens operate at 270F, and their heaters are mounted in the walls and ceilings. Baking areas are partitioned off from the heaters. Fans circulate air to assure even heat.



CEILING-HUGGING OVEN helps make up 2,000-kw demand with forging, heat-treating, solution-heating, and welding

*(Formerly Consolidated Gas Electric Light & Power Co of Baltimore)

INDUSTRIAL NEWS NOTES

Pampered Robot

Even robots want air-conditioning these days. Franklin Life Insurance Co's Univac, now being installed as an office tool in Springfield, Ill., will get the electric equivalent of 60 tons of ice a day to cool its metal brow. Its 5,000 tubes generate 400,000 Btu/hr—enough to heat 20 average-sized six-room houses, Worthington Corp engineers say.

•

Pinpointed Heat

High-frequency resistance welding, being introduced by New Rochelle Tool Corp, "pinpoints" energy to concentrate heat intensely in the seaming of continuous tubes. Current is directed into the edges being joined, and it works on untreated hot- and cold-rolled steel, stainless steel, copper, aluminum, and brass. It has produced welds that tested equal to the parent metal in strength.

•

Cig Paper Gets 'the Eye'

Peter J. Schweitzer, Inc, is giving "the eye" to cigarette paper processing at the Spotswood, N. J. plant. Closed-circuit TV monitors a pulp-washing tank to forewarn of plugging and jamming. Both require a costly shutdown for repairs. One man, two floors below, thus can keep a critical eye fixed on this tank while attending several other pulp-preparation machines. He no longer must scurry up and down to assuage his nerves. Connected load is about 300 w.

•

Not a Drip

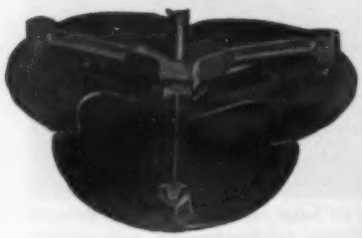
A no-leak seal for electrical connections that will withstand 170,000 psi has been developed at the National Bureau of Standards, Washington, D. C. Made of inexpensive materials, it may find many uses in the chemical, metallurgical, petroleum, and refining industries, or wherever high-pressure operations are monitored or controlled electrically. It works with sapphire or quartz bushings, which have high mechanical strength and good insulation qualities.

(*More Industrials on page* 116)

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all other. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

INDUSTRIAL—Design

'Shadowless Light' Created

Special "shadowless lighting" has been developed to deal with bright reflections on TV chassis assembled at Sylvania Electric Products, Inc, at Batavia, N. Y. Designed to spread reflections, thus reducing their brightness, the system has two continuous rows of dual, 90-w open-end industrial units mounted side by side, shielded by 32-in.-square sections of white diffusing corrugated vinyl plastic.

Greatest uniformity of brightness occurs when corrugations run at right angles to lamps. Panel brightness hits 300 ft-l.

Shielding is mounted 2 in. below reflectors, and 54 in. above the average TV chassis. Shadows from the worker's hands are eliminated, the company reports, improving the seeing task.

The old plant, which had unshielded lamps, produced brilliant reflections which tired workers' eyes. Errors in assembly necessitated trouble-hunting and repair. The condition was further aggravated because workers could not position the cumbersome chassis for best utilization of light.

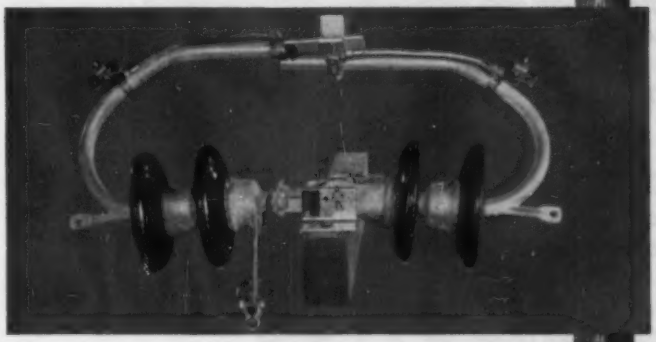
5-Hp Fan Exhausts Wood Sandings

Dust and excessive heat, which result from cutting and sanding of wooden boxes for the luggage trade, are exhausted from the plant of Ace Woodworking Corp, Philadelphia, Pa., by a 5-hp electric fan. This system has helped to increase production by reducing air contamination, which saves clean-up time, and by improving employee morale. Ducts carry the residue directly from machines to an outdoor cyclone tower. Duct openings also are provided at selected locations on the floor.—L. Albertson, Application Engineer, Philadelphia Electric Co, Philadelphia, Pa.

Compare pole top appearance!

KPF Switches

modern functional attractive



KPF Air Break Switches look different because they are different. Their pole top appearance is neat and uncluttered. There is a "straight-through" cleanliness of line—the visual appeal of design simplicity.

With this simplicity goes operating dependability and long life. There are no delicate mechanisms to malfunction, freeze, lock from cross-arm warping, need lubrication or wear out. This same simple construction also saves weight. KPF phase units weigh about the same as a comparable insulator stack. Double cross-arms and extra bracing are not needed. Installation is faster and less expensive.

KPF Switches have proved themselves in nearly a half century of major system operation. Why not get the details and make a test installation.

For catalog and complete specifications, write direct

KPF ELECTRIC COMPANY

Dept. E, 1624 E. Alpine Avenue
Stockton 5, California

KPF
AIR BREAK SWITCHES
Standard for nearly half a century

CHICAGO EXPOSITION OF POWER & MECHANICAL ENGINEERING

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AT THE EXPOSITION YOU'LL SEE new ways to put power to work for greater productiveness and economy—a world of new, helpful information under one roof!

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CHICAGO EXPOSITION OF POWER & MECHANICAL ENGINEERING
Under the auspices of the ASME

Management: International Exposition Company
480 Lexington Avenue, New York 17, N. Y.

INDUSTRIAL BRIEFS

Bending plywood at Condon Industries' plant, Harvey, Ill., is done with heat and pressure applied to the piece by a 2¼-in. steel cylinder. The plywood pieces are ⅝ in. thick and 12 in. wide. The 2¼-in. steel cylinder contains two 1,000-w and two 500-w heating elements. These are separated from the cylinder walls by glass fiber insulation. The cylinder is 52 in. long, and four strips of wood can be bent at once. R. F. McShane, Power Sales Engineer, Public Service Co Div, Commonwealth Edison Co, Harvey, Ill.

Drying cards, posters, and signs which are printed by the silk-screen process has speeded production and reduced the space required for the output of Screen Print Advertising Co of Fresno, Calif. Formerly the cards were racked for air drying, but now six 2.5-kw radiant heaters complete the drying process on the conveyor belt. J. E. Hammond, Commercial and Industrial Supervisor, Pacific Gas and Electric Co, Fresno, Calif.

Dissipating heat from around large bread dough mixing bowls of the Red Owl Food Stores, Minneapolis, is done by refrigerating units that circulate a cooling liquid in the shells surrounding the bowls. Red Owl has three large dough mixers for bread and cakes. Each mixer is driven by a 40-hp motor. Friction during mixing creates heat which must be taken away rapidly. This is done by the 30-hp refrigerating units, one for each mixer. The machines form part of a production line bread baking process. Howard R. Plahn, Power Sales Engineer Northern States Power Co., Minneapolis, Minn.

Asphalt is melted in an 8-kw electric kettle at the plant of Wilbert Vault Co of Kansas City, Kansas City, Mo. Hot asphalt is applied to the inside of burial vaults which the company builds. Gas kettles were used formerly, but an electric kettle was chosen for the company's new plant. It offered the advantages of safety, mobility, and accurate temperature control. It can be taken where needed by an electric crane. The kettle draws 20,000 kwhr a year. H. C. Erwin, Power Sales Engineer, Kansas City Power & Light Co, Kansas City, Mo.

Connect 'em for keeps ...with compression

KEARNEY SQUEEZONS

Exclusive "built-in-spacer" Prevents Strand-Cutting

The conductors can't be mashed together in a SQUEEZON connection. KEARNEY's exclusive "built-in spacer" design holds each conductor individually, gripping it around its entire circumference. Strand-cutting, pinching or any other kind of distortion is prevented.

Also, this "built-in spacer" provides the metallic mass necessary to prevent and withstand electrolytic action . . . even in bi-metallic connections.

Time-saving, trouble-saving KEARNEY SQUEEZONS are available in types and sizes for all types of above-ground distribution connections. They are applied in a minute with either a hydraulic or mechanical tool.

-205

For Better Construction . . . Safer Maintenance

JAMES R. KEARNEY

Specify **KEARNEY PRODUCTS** *The Mark of Quality*

JAMES R. KEARNEY CORPORATION • 4234-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant: GUELPH, ONTARIO

Hawaiian Electric Co Finds Joint Venture . . .

Cuts Home Promotion Costs

A newspaper, the realtor, and suppliers all got behind this 'Cinderella' home. Result: Big opening at shoved-down expense

Model electric homes can be promoted effectively with minimum outlay.

By teaming up with the local newspaper, realtor, merchants, and supply firms, Hawaiian Electric Co attracted 1,700 visitors daily for a month to an Oahu Island "Cinderella" home.

Here's what each participant contributed to the project:

• Hawaiian Electric provided the wiring for the home's extensive lighting. Indoor lighting load is 4.9 kw, outdoor, 1.4 kw.

BIG ATTRACTION was this kitchen. Its connected electric load is 21 kw

• The "Honolulu Advertiser" gave extensive newspaper coverage prior to the home's construction and during public display. It also paid for cleaning the home during the promotion.

• A realtor and more than 12 merchants and supply firms erected and furnished the home. Construction cost of $32,000, excluding land, was paid by the realtor who sold the home after the promotion.

The whole project proved so successful that two more model homes were planned before the promotion campaign ended, one by the Honolulu Gas Co.

With a connected load of 38.8 kw, the "Cinderella" home included the latest in electric lighting and appliances. Samples: an electronic telephone secretary that automatically records messages when the phone is unattended, pushbutton-operated draperies, and a built-in high-fidelity system.

Kitchen was equipped with cooking top and oven, refrigerator, freezer, dishwasher, garbage disposer, exhaust fan, clothes dryer, washer, and ironer. A room air conditioner was installed in the master bedroom.

Two home economists from Hawaiian Electric and representatives of the realtor and various suppliers were on hand during the promotion to answer visitors' questions.

'55 Sales Booming

Chattanooga does $5.3-million appliance business while AG&E heads for record year

The electric appliance business has been brisk for the first half of this year, judging from the figures received by Electrical World.

Residents of Chattanooga bought $5.3 million worth of house-hold electrical appliances, the City Electric Power Board reported.

Of this $1.2 million went for 5,000 television receivers, and $670,000 for 2,300 air conditioners. Other sales totaling more than a half million dollars included electric refrigerators, electric ranges, and automatic clothes washers. Quarter-million-dollar sales were recorded for water heaters and frozen food cabinets. During the first half of last year, residential appliance sales recorded a slightly higher figure —$5.5 million.

Meanwhile, American Gas & Electric companies report they may be headed for a record year if the sale of home appliances follows the trend of the first six months.

New Record for AG&E

AG&E's Commercial Vice-President Paul D. Brooks reports the sale of 51,000 electric ranges, water heaters, and dryers, which is 7,000 more than were sold in the first half of 1953, a year with a record sale of 137,000 units.

In promotion of commercial and industrial use of electric energy on the system, AG&E has added during the first six months 101,000 kw of new commercial and industrial load (lighting, cooking, and air conditioning). This represents an increase of 35.8% over the first six months of 1954—the previous record year.

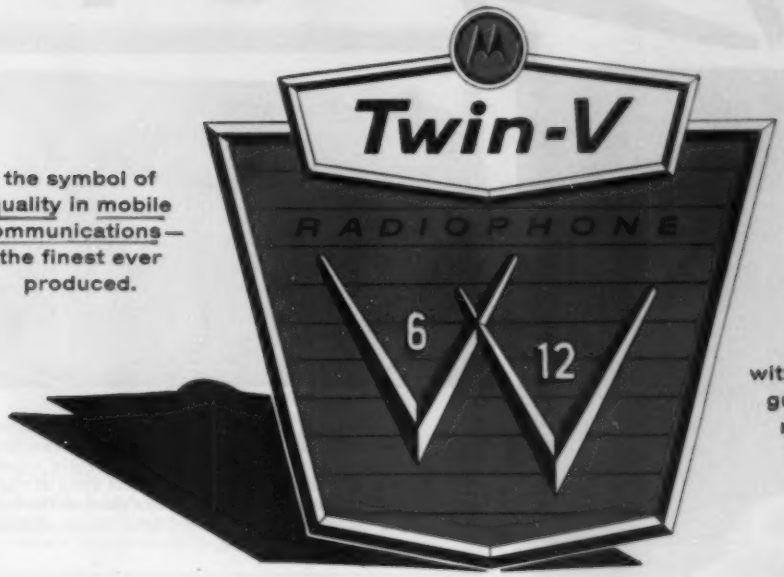
People Are Buying in Kansas

Kansas Gas & Electric Co laments that cool weather "torpedoed" unit room cooler sales in June. But, excluding cooling devices, unit sales of appliances in June of 1955 gained 1.1% over those of last year. Cumulative figures (still excluding cooling devices) show a 7.2% gain.

(*More S & S on page* 124)

THE NEW STANDARD OF 2-WAY RADIO EXCELLENCE

the symbol of quality in mobile communications—the finest ever produced.



with built-in reliability guaranteed by the name *MOTOROLA*

Radio equipment bearing the TWIN-V trademark *ASSURES YOU ESTABLISHED MOTOROLA QUALITY* plus many new and exclusive advance-engineered features

NOW available—the most complete line of precision built, two-way radio models, vibrator *or* dynamotor powered . . . featuring foolproof 6/12 volt interchangeability, the solution to today's installation problems in mixed fleets of 6 and 12 volt vehicles.

There is a model designed for each and every application in the 24-54 mc., 144-174 mc., and 450-470 mc. frequency ranges, with a wide selection of transmitter power output ratings to serve your varied communications requirements. Take your choice of compact, economical, vibrator powered models or rugged, long life, dynamotor powered units to serve your specific operational needs.

These models give you improved communications range, maximum intelligibility through better receiver sensitivity—better circuitry for control of ignition noise, "hash" and other interference—better audio response for clearer, crisper voice messages that get through even under the worst conditions—better squelch operation to reliably block out nuisance noise, yet resets instantaneously to receive the weakest useable signal.

Here is equipment designed to new higher performance standards—built to last . . . built to accommodate changing operating conditions, economically and functionally . . . built to more readily accommodate conversion to split-channel conditions. All Motorola units are fully field tested, proved in use, proved for sustained peak performance, proved for minimum maintenance.

Get the complete details on the new "TWIN-V" Radiophone. A Motorola communications specialist is in your area ready to help. Phone, write or wire *today* for complete descriptive literature.

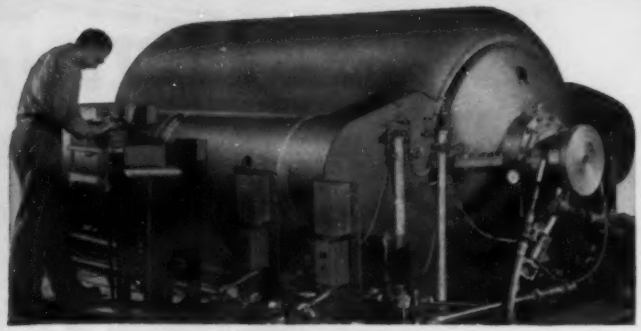
MOTOROLA

2-WAY RADIO

MOTOROLA COMMUNICATIONS & ELECTRONICS, INC.
A SUBSIDIARY OF MOTOROLA, INC.
4501 AUGUSTA BOULEVARD • CHICAGO 51, ILLINOIS
ROGERS MAJESTIC ELECTRONICS LTD. TORONTO CANADA

Motorola consistently supplies more mobile and portable radio than all others combined.
Proof of acceptance, experience and quality.
The only COMPLETE radio communications service—specialized engineering . . . product . . . customer service . . . parts . . . installation . . . maintenance . . . finance . . . lease.
"The best costs you less—specify Motorola."

Fully Super



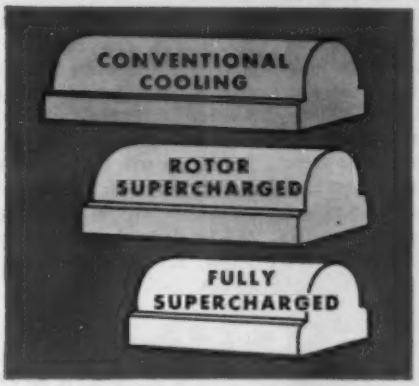
TEST UNIT establishes a basis for designing 3600-rpm units that can be rated 300 mw and higher. On initial test setup, the fully supercharged generator was given heat runs at various hydrogen pressures. Tests showed the output is more than doubled as a result of fully supercharged cooling.

Designers' model approximates appearance of fully supercharged generator on 150,000-kw steam turbine unit.

A-C ALLIS-CHALMERS

ALLIS-

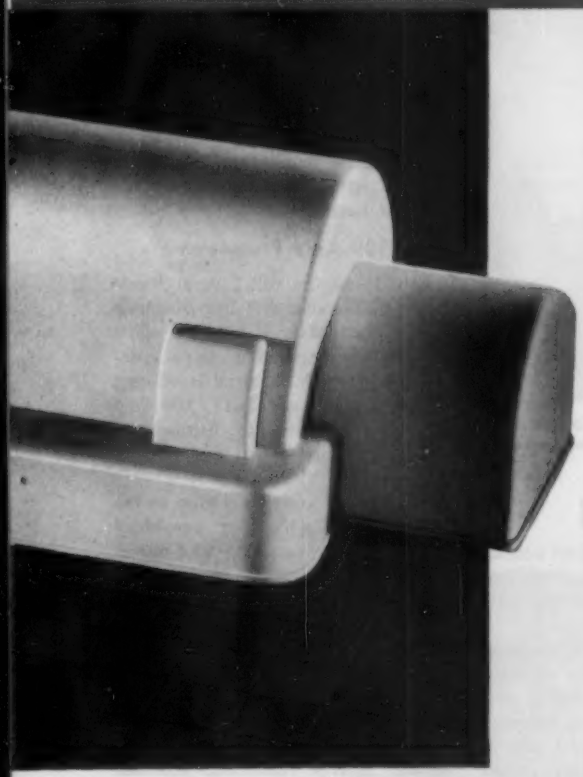
charged cooling!



OUTLINES SHOW ADVANTAGES in comparable length . . . first with rotor supercharging . . . and now with full supercharging to reduce size even further.

Now

Allis-Chalmers reports on tests of a generator with supercharged cooling of both rotor and stator



EXPERIENCE shows that supercharged cooling pays off. The Allis-Chalmers pioneered development, applied to rotors only, already delivers important savings to utilities. Five steam turbine-generator installations now have a combined total of eight years' operating experience. Plants can be smaller, less costly to build. Switchgear costs are lower. Shipping and installation are simplified. Important operating advantages have been proved.

A fully supercharged generator test unit — with supercharged cooling applied to both rotor and stator — has now been built. It has mechanical, magnetic and cooling features which permit maximum utilization of Allis-Chalmers supercharged cooling design. This design provides conductor cooling with high velocity gas flowing over ample exposed area.

Performance surpassed expectations

Test efficiencies exceeded predictions and temperatures were favorable. Electrical characteristics were exceptionally favorable. Mechanical features, including thrust-type hydrogen seals, proved unusually effective.

Overall tests show that fully supercharged cooling — of both rotor and stator — will provide steam turbine generators with advantages in size and performance far superior to previously built designs.

Complete information on these tests is available in "Fully Supercharged Generator — Performance Exceeds Expectations." Get a copy from your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-4661

CHALMERS

Pink Lighting Trend Is Not Political

There's a pink, but non-political, trend in lighting these days. Sylvania Electric Products Inc. revealed Aug. 15 that it is bringing out a less efficient bulb with a marked-up price. But it should sell fast and profitably to housewives. Five days later, General Electric announced a similar line. Westinghouse is expected to follow suit.

Sylvania's bulb is dubbed "Softlight," and sheds "pearl pink" rays. GE refers to its line as "de luxe pink bulbs," and offers a 25-w flame-shaped design and a 50-GS bulb. Both companies are to market ordinary 75, 100, and 150-w sizes in September. In addition, Sylvania will have a three-way bulb in Softlight.

Utilities stand to derive even greater revenue from residential lighting if these bulbs "catch on." For a given wattage, they shed less light because some of the standard incandescent's yellow and green rays are removed by a special coating on the glass.

To obtain roughly the same amount of illumination, the housewife must replace a standard incandescent with the next-higher-wattage pink bulb.

But Sylvania lighting experts believe housewives will not mind these drawbacks. In a West Coast test city, Softlight sales outstripped regular incandescents by 75%, Sylvania reports.

Both companies believe pink bulbs will appeal to women. Both lines eliminate sharply defined shadows, producing more of an indirect lighting effect. Moreover, this light is so kind to flesh tones that Sylvania recommends that it **not** be used at makeup mirrors.

As GE puts it: "The new pink bulbs will give a new radiance to complexions, enrich warm colors in fabrics, pictures and foods, add luster to polished furniture, soften shadows, and reduce glare."

Sylvania will introduce its 75 and 100-watt bulbs in units of four, selling for $1.09. GE will price its line at 25¢ for flame-shaped, 29¢ for 75 and 100-w, 32¢ for 150-w, and 49¢ for 50-GA.

UTILITY LIGHTING EXPERTS were among speakers at Arizona State College workshop. Coeds and teachers were given home ec credits for completing course

Workshop Boosts Lighting

Home lighting will be included in home economics and industrial art courses in at least 22 Arizona high schools this year, a direct result of a week-long workshop co-sponsored by Arizona Public Service Co and Arizona State College.

Some 51 students, including architects, home decorators, teachers, students, and lighting advisors from four Arizona and New Mexico utilities attended the workshop held on the college campus at Tempe. Speakers included educators, utility lighting experts, and representatives of the home lighting industry. They distributed literature and used movies, slides and other visual aids to carry out class discussion. Those who registered for college credits and passed the final examination received a one-hour home economics credit.

Because of the interest, Public Service and Arizona State tentatively plan to offer a similar course at the college's summer school next year.

S & S SHORTS

Baseboard Air Conditioner

A new air conditioner, said to be the only baseboard model on the market, and suitable for multi-room installations is announced by Circle-Air Industries, Inc, Brooklyn, N. Y. Maker says unit makes year-round air conditioning possible on jobs where it was previously impractical or impossible. It requires no ducts and operates on the same piping circuit used for heating.

More 100-Amp Promotion

Electric utilities will have a chance to get in another lick for adequate wiring when Murray Mfg Co starts its 100-amp-installation sales campaign this month. Murray is offering a free 12-page booklet "100-Amp Service" for utilities to distribute to contractors, architects, and wholesalers.

The booklet urges its readers to tap the annual $100-million new-home market, and to pursue the $3.5-billion market awaiting them in electrical household modernization.

Meanwhile, Murray will reach contractors and distributors through national and regional trade journals, and through direct-mail advertising. The company also plans to send imprinted leaflets to wholesalers for distribution to the latter's customers. Counter cards and wall charts for the wholesaler's office are being created to provoke thought at the point of sale.

For top value . . . in any type . . . get JENKINS

Gold Seal Tape

FRICTION • RUBBER • PLASTIC

BEST BUY FOR PLANT SUPPLY

All types of **GOLD SEAL TAPE** — Friction, Rubber, Plastic — are packed in 10-roll cartons as well as single rolls.
Every roll cellophane-protected, stays fresh.
Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

DIAMOND SEAL
Friction and Rubber Tapes
are also made by Jenkins Bros. to ASTM specifications.

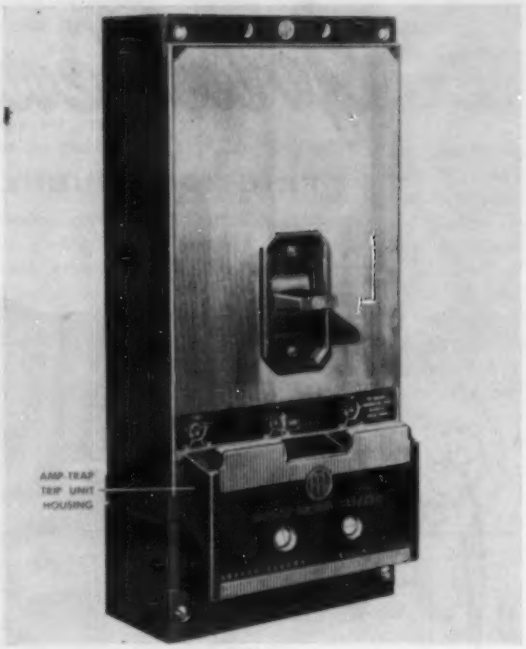
Fused Circuit Breakers

The operational advantages of low-voltages molded case circuit breakers have been combined with current limiting fuses to extend the CB's short circuit current rating from 25,000 amp to 100,000 amp (rms) at 480 v.

In the Cordon circuit breaker, current limiting fuses (Amp-traps) take over the duty of the breaker at about 80% of its standard interrupting rating. Tests are reported to show that the total clearing time of the fuse is less than ¼ cycle. Attached to the fuse is a spring-loaded plunger that is actuated when the fuse blows. This automatically opens the breaker contacts through a mechanical linkage, thus preventing a single phase condition. The plunger also indicates in which phase or phases the fuse has blown. Until blown fuses have been replaced, the breaker cannot be reset.

The Cordon breaker also has conventional thermal time-delay and instantaneous overcurrent trip devices. Operation of either will also automatically open all phases.

I-T-E Circuit Breaker Co, 19th & Hamilton Sts, Philadelphia 30, Pa.



Truck-Mounted Generator

A 12.5 kw, truck-mounted generator features plug-in outlets for 110 or 220 v ac, single phase, or 220 v, three phase.

Electrall, as it is called, is factory-installed optional equipment on series R-110, 120 and 130 pickup trucks and is available for installation on larger models. It is belt-driven by an independent power takeoff gear from the transmission. The unit weighs 325 lb and can be removed from the truck when not needed.

International Harvester Co, 180 N. Michigan Ave, Chicago 1, Ill.

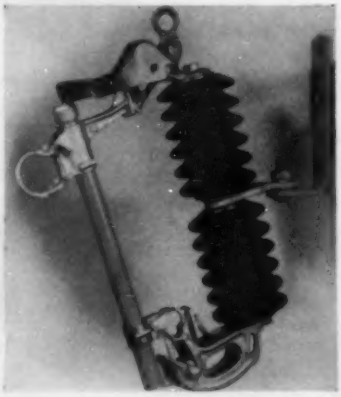
Distribution Cutouts

Types CV-33-F and CV-33-FH distribution cutouts feature a tube venting design which permits gases to escape at both ends of the fuse tube. The top escape ports directs the high velocity gases away from all live parts, reports the manufacturer.

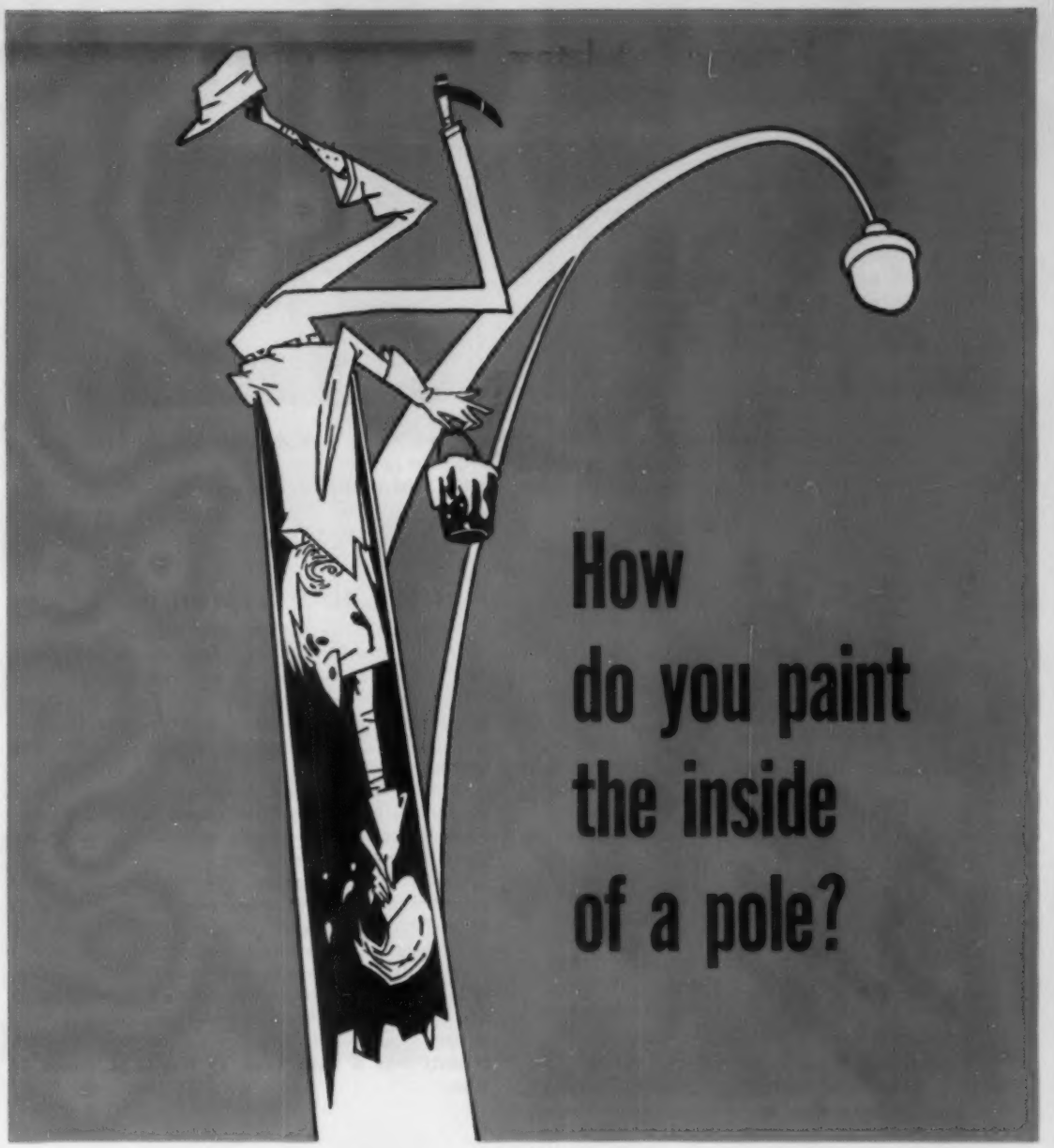
Both types are designed to accommodate universal button head fuse links only.

The cutouts are available in continuous ratings of 100 and 200 amp for 5, 7.5, 15 and 25 kv circuits.

Southern States Equipment Corp, Hampton, Ga.



(*More New Equipment on page* 128)



The answer is—you don't. Consequently, if the pole is made of corrosive metal, rust accumulates in the damp interior and weakens the wall, even though the exterior is regularly painted and maintains a deceptively fresh appearance. Rust scales pile up in the base, accelerate corrosion, endanger the insulation of the wiring, and greatly reduce the impact resistance of the pole.

Hapco Aluminum Alloy Poles don't deteriorate with age. They stand up through all kinds of weather, under the severest atmospheric conditions. They never require painting or other treatment to prolong their life. And their *installed* cost, due to their light weight and easy handling, is much less than that of ordinary metal or concrete poles.

HUBBARD ALUMINUM PRODUCTS COMPANY
Division of Hubbard & Company
Pittsburgh 1, Pa.

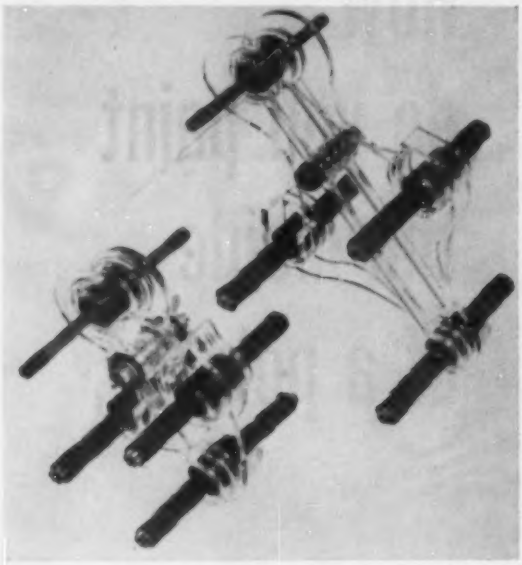
Voltage Regulators

The "Vari-Amp" feature, enabling distribution engineers to "tailor-make" their own range of regulation in accordance with individual system needs is now available on all this manufacturer's single and three-phase step regulators (Types AFR, DFR and JFR).

This feature provides five steps over which current capacity can be increased by reducing the range of regulation. For example, on distribution regulators, the "Vari-Amp" setting permits an increase in current rating up to 160% as the regulation range is reduced from ±10% to ±5%. On three-phase power units, rated current can be increase to 126% with only a small reduction in regulator range.

In addition, DFR regulators are now given thermal ratings under which they may operate continuously without exceeding guaranteed temperature rises. Thermal ratings as high as 133% of nameplate rating have been applied to most DFR units. Losses, kva, and other performance data of DFR regulators continue to be based on nameplate ratings.

Allis-Chalmers Mfg Co, Milwaukee 1, Wisc.



Aerial Cable System

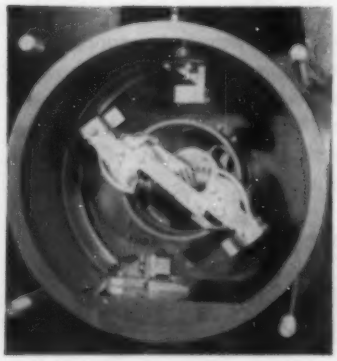
Plastic cable clamps (EW, May 30, 1955, p 158) are the heart of the Hendrix aerial cable system which maintains equidistant spacing between conductors and messenger instead of spiraling and binding them to form a single cable. The system is said to require no shielding and only enough insulation for protection against voltage breakdown under unusual conditions.

Clamps are placed on conductors at 30-ft intervals. For circuits under 5 kv, Tri-3 clamps (left) are used for 3-in. spacing, and for circuits over 5 kv, Tri-6 clamps (right) are used for 6-in. spacing.

Conductors are aluminum. The 5-kv conductors are insulated with vinyl plastic tape wrapped and heat sealed at the factory. Higher voltages are insulated with polyethylene and then covered with vinyl tape.

The plastic clamps consist of two identical sections. When the sections are bolted together, openings in adjacent hooks form a tubular housing for conductors which are held firmly by split-ring neoprene bushings.

Hendrix Wire & Cable Corp, 19 Watson St, Boston 18, Mass.



Tap-Changing Contactor

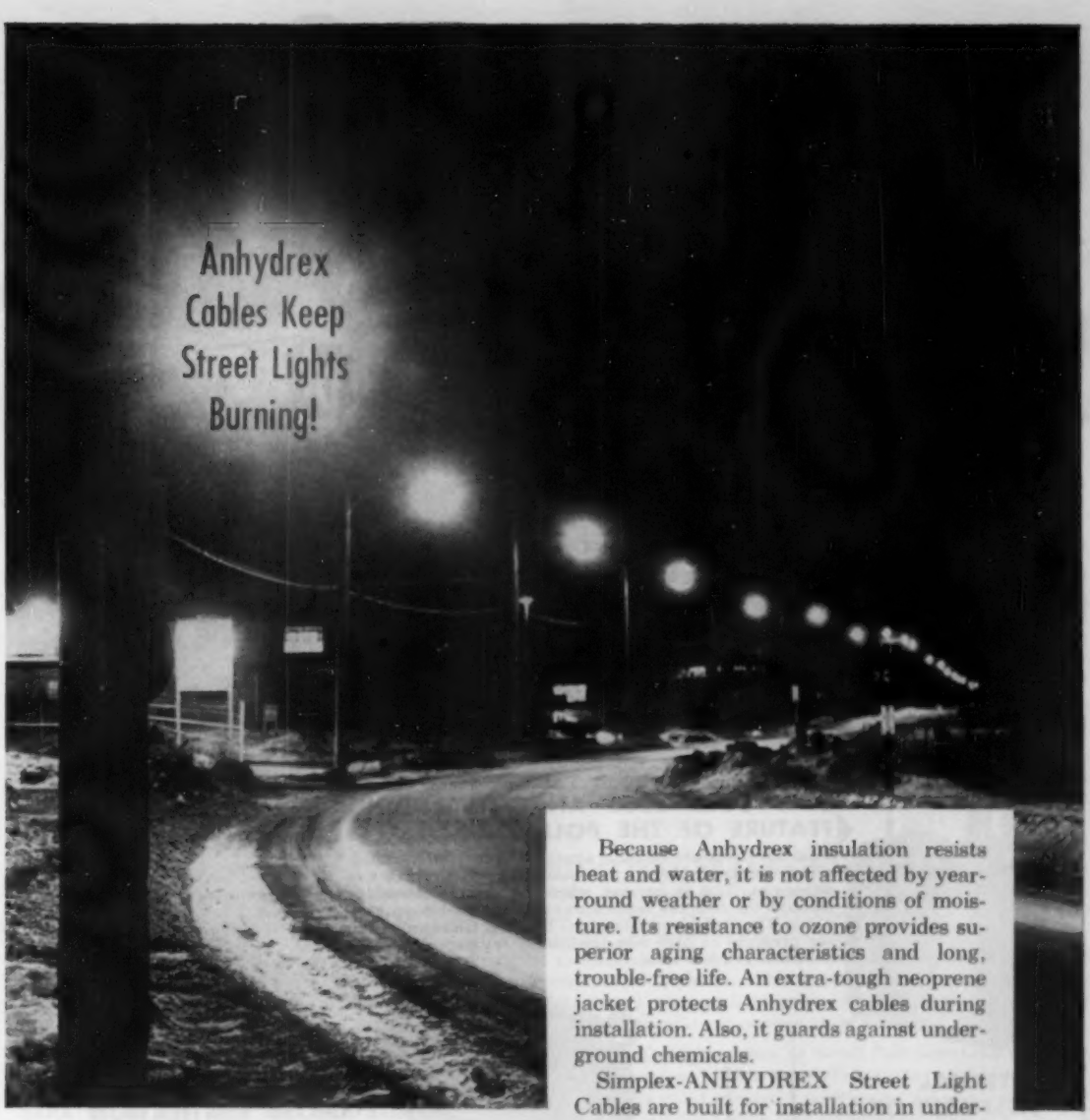
A heavy-duty contactor is expected to almost triple the range of regulating autotransformers. These units with ± 10% regulation have been limited to about 150,000 kva. The LR81 contactor will extend that limit to around 400,000 kva.

The LR81, rated for 3,000-amp continuous duty, is of the double-break, oil blast type, and is insulated for 46-kv circuits. It is said to be capable of completing a tap change at heavy overloads up to the full short circuit rating of the transformer. Arcing contacts are designed to make 50,000 tap changes under full load.

General uses for the contactor will be on phase-shifting transformers for large capacity and in power transformers where, to save weight and losses, the usual series transformers have been eliminated.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.

(*More New Equipment on page* 132)



Because Anhydrex insulation resists heat and water, it is not affected by year-round weather or by conditions of moisture. Its resistance to ozone provides superior aging characteristics and long, trouble-free life. An extra-tough neoprene jacket protects Anhydrex cables during installation. Also, it guards against underground chemicals.

Simplex-ANHYDREX Street Light Cables are built for installation in underground conduits, for burial directly in the earth, or as aerial cables supported by a suitable messenger.

Their simple construction means faster splicing and connecting at terminals. Compared to lead-covered cables, the lighter Anhydrex Cables are easier to handle.

These cables meet all specifications and requirements of I.M.S.A., I.P.C.E.A., and A.S.T.M.

If you have problems connected with the wiring of street lights, write to the address below. No obligation, of course.

Simplex

STREET LIGHT CABLES

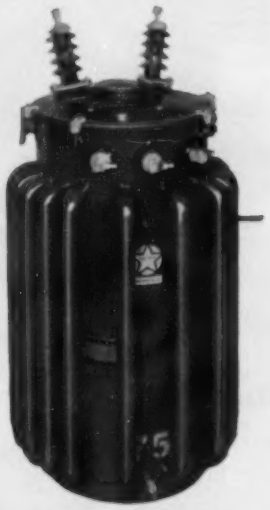
SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

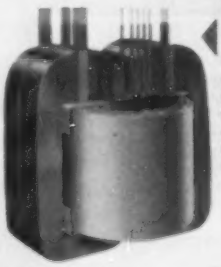
PENNSYLVANIA Pole

The Lapped Core Makes the Difference

The patented design of the Pole Star Core enables Pennsylvania to build Pole Star Transformers through the entire range of EEI-Nema distribution sizes, from 3 Kva through 500 Kva, and from 480 Volts through 67,000 Volts. The Pole Star takes full advantage of the high permeability and low loss characteristics of the oriented electrical steel used in making the lapped core. This results in a core with low exciting current and low core loss. In every voltage rating, the Pole Star is lighter in weight and smaller in size than the stacked core transformer it replaces. The Pole Star is economical to operate and easy to install. *In short, the Pole Star is an Outstanding Product . . . Operating with Great Efficiency at Low Cost.*

75 Kva





LOW CORE LOSS—AN OUTSTANDING FEATURE OF THE POLE STAR

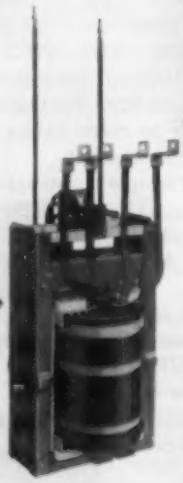
Pole Star cores are carefully annealed in controlled-atmosphere furnaces, but do not suffer the disadvantages of adhesions. That is because when the core is assembled through the coil, the laminations are separated from each other. The absence of adhesions between laminations and the presence of high interlamination resistance keep the core loss at a low value.

NEW BASE FEATURES CROSS VENTILATION

Structural steel bars are welded to the tank bottom. Their arrangement permits the transformer to be rolled in any direction. Jack lugs extend beyond the tubes or radiators. Openings provide cross ventilation for the tank bottom and the base. The entire tank bottom is accessible through the openings for painting.

INTERNAL ASSEMBLY OF 167 KVA POLE STAR

Side frames completely enclose the core and provide a sturdy support for the entire unit. The Pole Star coil is designed for a low temperature gradient and a high overload capacity. Large oil ducts are provided in the coil to permit a free flow of oil through the coil. High voltage and low voltage windings are properly balanced to minimize the effects of short circuits.



CORE BUILDER ASSEMBLES LAMINATIONS THROUGH 500 KVA POLE STAR COIL

Core laminations are individually lapped. There are no gaps or butt joints in the Pole Star core to cancel out the advantages of the cold-reduced, oriented electrical steel. The lapped construction reduces the flux density at the joint and maintains the low reluctance path of the Pole Star core.

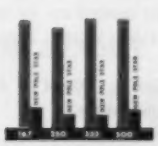
Star TRANSFORMERS

in sizes

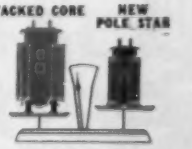
3 Kva through 500 Kva

480 Volts through 67,000 Volts

Compare THE NEW 500 Kva POLE STAR WITH THE OLD 500 Kva STACKED CORE TRANSFORMER



EXCITING CURRENT REDUCED 75%



WEIGHT REDUCED 2200 POUNDS

OIL VOLUME REDUCED 35% (125 GALLONS)

NEW POLE STAR — STACKED CORE

FLOOR AREA REDUCED 20%

STACKED CORE — NEW POLE STAR

1 YOU WILL GET BETTER PERFORMANCE *Because* Pole Star transformers have a reduced core loss and therefore operate at higher efficiency. The Pole Star core uses to best advantage the superior magnetic qualities of cold-reduced oriented electrical silicon steel.

2 YOU WILL GET BETTER VOLTAGE REGULATION *Because* Impedances have been reduced. Better customer relations will result since lower impedances mean less voltage fluctuation during load changes, and less voltage drop during peak loads.

3 YOU WILL SAVE MONEY *Because* Pole Star transformers have lower exciting current — *the current needed to magnetize or excite the core.* Since it is always present — under *any load* or *no load* conditions — a certain amount of generating Kva must be earmarked for exciting current and nothing else. In terms of hundreds of transformers, this generating Kva can mount up to large amounts of generating capacity, supplying nothing but exciting current and returning no revenue to the utility.

It is good business, therefore, to install Pole Star transformers on *your* lines. Under *no load,* less generating capacity would be required. At *full load,* the utility will derive more output per unit of generating capacity. By installing Pole Star transformers with low exciting current, real dollar savings can be achieved.

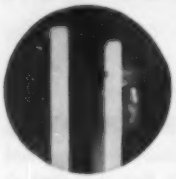
4 YOU WILL BE USING SMALLER TRANSFORMERS *Because* Pole Star transformers from 167 Kva through 500 Kva are as much as 28% lighter and 30% smaller in size. This means you will get *more Kva per pound* when you install Pole Star transformers on your lines. It further means that when you must replace your old transformers because of heavier loads, you can install larger Kva-rated Pole Stars with little or no increase in size or weight.

PENNSYLVANIA
TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PA. • *Greater Pittsburgh District*

Ask these questions, too, when you judge a fluorescent lamp...



Is its phosphor factory-controlled for color match?

Westinghouse makes its own fluorescent lamp phosphors . . . to be sure of strictest uniformity. Thus *you* can be sure that the Westinghouse lamp you buy today will exactly match the Westinghouse lamp of the same color classification you bought yesterday or years ago.

Are its electrodes built for longest lamp-life?

Constant development of new and better ways to make fluorescent lamp electrodes has enabled Westinghouse to *triple* the life of its fluorescent lamps since 1948.

Is it the correct type, size and color for the lighting job to be done?

In the Westinghouse fluorescent family of 290 different lamps—including Slimline and Rapid Start—there's a type and size precisely right for every office, plant and merchandising application. Colors include seven different shades of "white" alone.

For the full story on how to get more for your money in fluorescent light, contact your Westinghouse Lamp Representative.

YOU CAN BE SURE...IF IT'S

Westinghouse

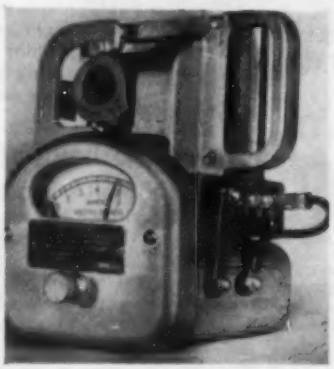
Luminaire

Open refractor luminaire designed primarily for either 100 or 175-w mercury vapor lamps can also accommodate incandescent lamps through 6,000 lumens. Features of the luminaire are reported to be rapid and easy relamping, and excellent cooling ability.

An alzak aluminum reflector with a diffusing surface is used for mounting the open refractor to the manufacturer's standard NEMA large head. Pressure latches insure positive attachment of the reflector to the head. A V-band clamp simplifies replacement of the glassware.

Refractors for the luminaire provide either IES Types I, II, III, or Type II four-way offset light distribution patterns.

Line Material Co, Milwaukee 1, Wisc.



Portable Meter

The junior MAX-I-METER (Catalog No. MM200) is a portable instrument for measuring and recording maximum current flowing in conductors. It weighs 9 lb and has a 2-in. window opening allowing it to be installed on conductors insulated with standard line hose as well as on primary conductor cables.

The unit is a weatherproof combination of a multi-ratio split core transformer and a thermal type maximum demand meter. Its easily changed ratios are 75/5, 125/5, 250/5 and 500/5. For high voltage circuits, meters are available with hot-line fittings to permit installation by hot stick. Write for Bulletin MM-2.

HD Electric Co, Deerfield, Ill.

Lightweight Magnet

This 55-in. magnet, designed for scrapyard boom cranes and for handling lightweight scrap, is said to weigh 5,200 lb—a weight saving of up to 25%.

Reported improvements are the use of aluminum strap in place of copper strap, and more effective use of coil winding area for high-lifting capacity. These are said to contribute to more favorable weight-to-lifting-capacity ratio.

Electric Controller & Mfg Co, 4500 Lee Rd, Cleveland, Ohio.

Potting Compound

PR-1201-Q is a white Thiokol synthetic rubber compound for use in electrical potting and sealing applications.

For use around electrical connections the compound is said to: Prevent entry of dirt, foreign matter, and

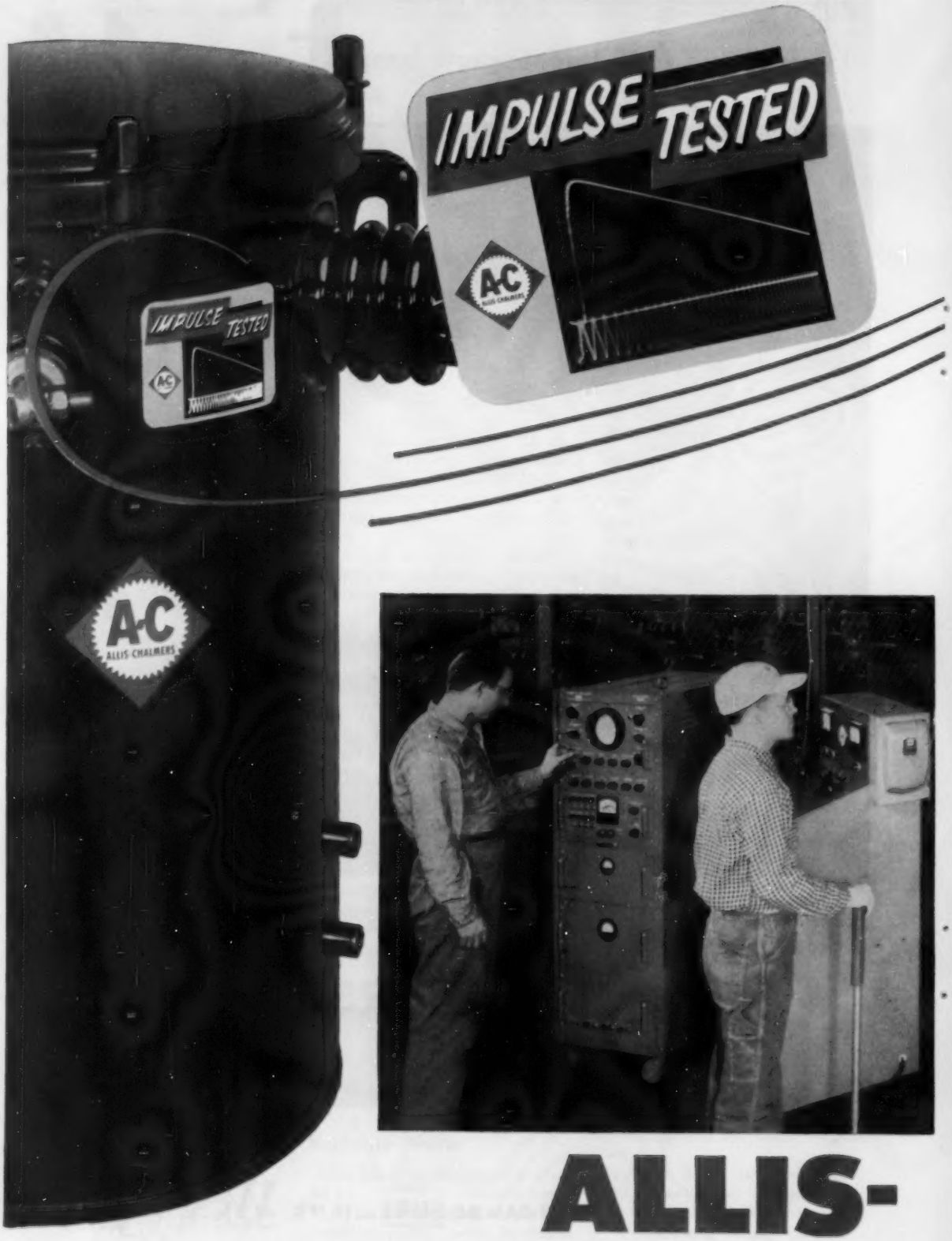
(*Continued on page* 136)

How to judge a fluorescent lamp ...point No. 1

ask about **HALO PHOSPHORS**

The "phosphor" in a fluorescent lamp is the light-producing coating inside the glass tube. Only if the phosphor successfully resists deterioration will the lamp—*1*) continue to give high light-output and—*2*) retain its original color to the end of its long life. Tops for deterioration-resistance among the different types of phosphors now in use are *Halo* Phosphors. Westinghouse (and only Westinghouse) uses Halo Phosphors throughout its entire fluorescent lamp line.

YOU CAN BE SURE...IF IT'S Westinghouse


IMPULSE TESTED
A-C
ALLIS CHALMERS
IMPULSE TESTED
A-C
ALLIS CHALMERS

ALLIS-

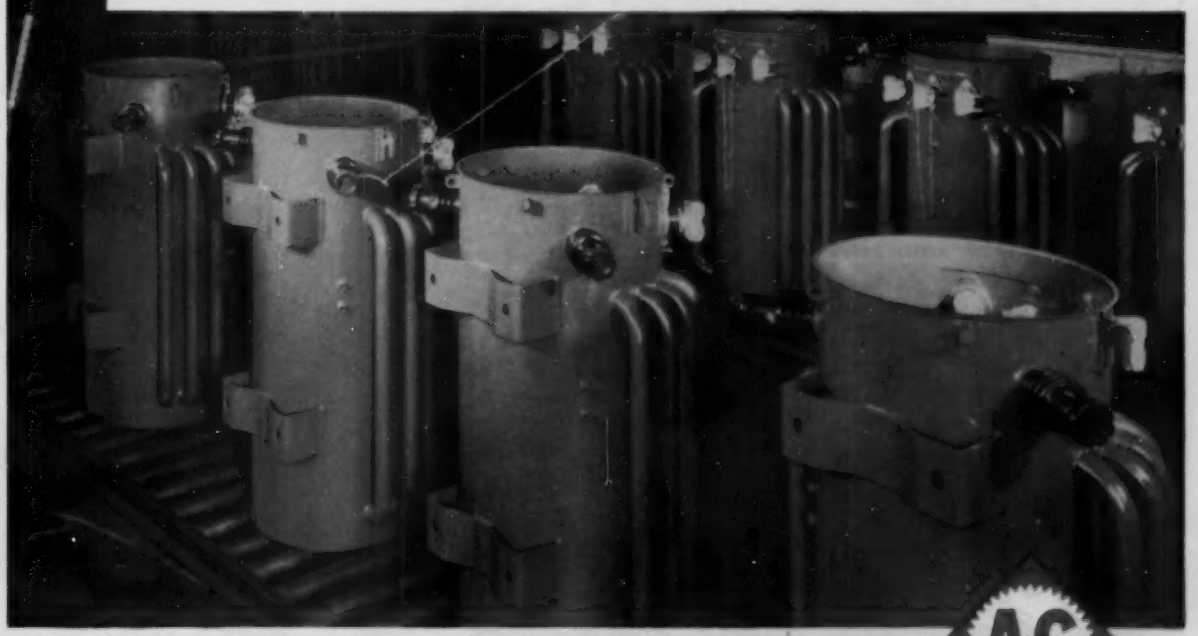
Now - On Every Allis-Chalmers Distribution Transformer

Now Allis-Chalmers gives you proof that insulation quality has been tested on *every* distribution transformer. The "Impulse Tested" seal on each unit through 500 kva, 69 kv and below, shows that impulse tests were made during production using the most modern impulse testing equipment.

Allis-Chalmers initiated production-line impulse testing eight years ago for pole type units. Now, every unit is shipped with positive assurance that its insulation can withstand severe lightning and line surge conditions. These tests are made on self-protected transformers as well as on conventional units. No lightning arrester is used in these tests. Allis-Chalmers tests only the transformer, not the lightning arrester.

Get the facts about this and other Allis-Chalmers tests and procedures that result in distribution transformers of the highest quality. For more information, contact the A-C office nearest you or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Insulation Quality Is Checked using this testing equipment for all Allis-Chalmers distribution transformers through 500 kva, 69 kv and below.



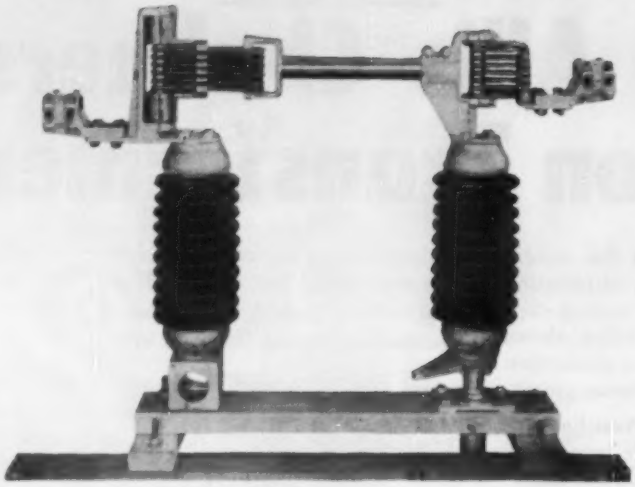
CHALMERS

A-C ALLIS-CHALMERS

A-4809

SIMPLE DESIGN

Excellent Field Service Record



ROYAL TYPE RLL

HORIZONTAL BREAK SWITCH

In electrical mechanical devices, design simplicity results in a product of quality. The record of the Type RLL is proof of this fact.

The high pressure front and hinge contacts are of high conductivity, high strength "Berylco #10" Beryllium copper. The large deflection factor of safety insures long life.

Developed in 1938, the Type RLL was the first side break switch that eliminated braid shunts at the hinge contact and in the blade.

The main bearing under the rotating insulator, developed in 1948, was the first to use aircraft type, permanently sealed ball bearings packed with silicone grease.

The Type RLL is manufactured in voltage ratings from 7.5 to 161 kv and capacities of 400, 600 and 1200 amperes.

Let us give you further details.

Royal

A Part of the Arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING COMPANY

INCORPORATED

1122 EAST 87th STREET Chicago 19, Ill.

New Equipment

(*Continued from page* 132)

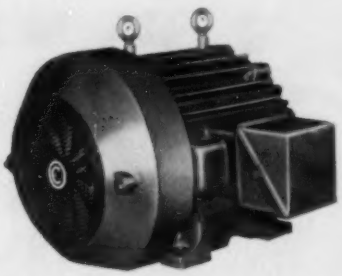
moisture, which may cause shorting; eliminate damage to soldered connections, thus allowing production line handling without special clamps; protect against vibration and shock; and offer resistance to fuels, oils, water and weather.

See chart for typical electrical properties.

(Specimens cured for 48 hr, plus or minus ½ hr, at temperature of 77F and RH of 50%, plus or minus 5%)

Resistance to Arc, sec.	34
Dielectric Strength, vpm	280
Dielectric Constant,	
10^6	9.5
10^9	9.5
Power Factor,	
10^6 @ 25C	0.005
10^9 @ 25C	0.024
Resistivity	
Volume @ 25C, ohm/cm	1.9×10^{13}
Surface @ 25C, ohms	1.2×10^{12}
Volume @ 85C, ohm/cm	6.0×10^{10}
Surface @ 85C, ohms	1.4×10^{11}
Insulation Resistance, megohms	
Diallyl phthalate insert	8,000
Resilient insert	8,000

Products Research Co, 3126 Los Feliz Blvd, Los Angeles, Calif.



Fan-Cooled Motor

Illustrated here is a 50-hp totally enclosed fan-cooled motor, one in the rerated 7½ to 100-hp series, reported suitable for use in dirty, dusty, fume and mist-laden atmospheres.

The motor line is claimed to meet all NEMA requirements, have "six-layer insulation" for stator windings, a ventilating fan which provides equal cooling efficiencies in either direction, and rib type cast iron frame construction for easy cleaning.

Century Electric Co, St Louis 3, Mo.

(*More New Equipment on page* 138)

The New Woodward Switching Station of the Arkansas Power & Light Company at Pine Bluff is a control center for the vast Middle South Interconnection. Load-Frequency Control and Telemetering are painstakingly matched to pool operating requirements—the work of E. C. Stewart, Systems Operator, in concert with a team of Leeds & Northrup Design and Application Engineers, two of whom are shown (standing) here. End result of their combined efforts: lowest operating cost consistent with reliable customer service. For a complete description of this installation, write to Leeds & Northrup Company, 4907 Stenton Avenue, Philadelphia 44, Pa. Or, talk with the men in any of 18 L&N District Offices—men who have made more than 300 matched-control installations.

LEEDS **NORTHRUP**

300 Load-Frequency Control Installations 1927-55

Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous *Crapo* Galvanized heavy, ductile, tightly-bonded zinc coatings.

and Economical, Too!

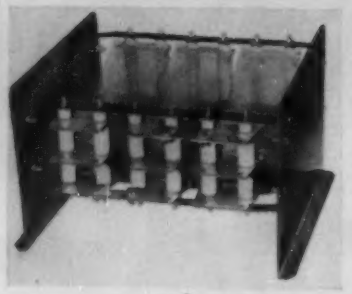
● Each size and grade of time-proved *Crapo* Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, *specify Crapo Steel Strand* for guys, messenger and overhead ground wires . . . and *save on maintenance!*

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

Contact your jobber of *Crapo* Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA



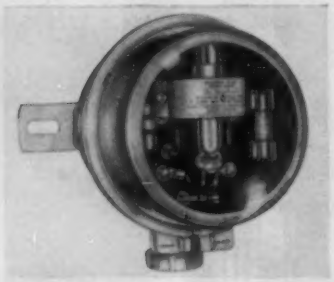
High-Current Resistor

Resistance units of high-current resistor are formed of self-supporting wire screen. This design is said to result in a compact, light-weight unit with a high heat dissipation capacity.

The "Wire Grid Resistor", as it is called, uses Nichrome wire in the form of V-shaped wire screen. Screen is brazed to large copper terminals. Mechanical design permits expansion and contraction of the screen with only minor forces exerted on the insulators.

Resistors are made in complete grid bank assemblies, either open or enclosed, in 31 standard current capacities from 32 to 126 amp.

Schaefer Bros. Co, 1059 W. Eleventh St, Chicago 7, Ill.



Multiple Relays

Series 100 and 200 multiple relays are designed for outdoor use as pilot wire control or for cascading street lighting circuits in low-voltage installations. Switches have a mercury plunger relay rated to switch 30 amp at 115 v ac.

The Series 100 relay is housed in a standard weatherproof watt-hour meter case. All components are mounted on a Bakelite chassis for surge and lightning transient protection. Models are available with or without protective equipment. Series 200 is housed in a weatherproof aluminum case. Both series are available with either normally open or normally closed relays.

Fisher-Pierce Co, 170 Pearl St, South Braintree, Boston 85, Mass.

Reflector

Stainless steel Directolite reflectors are said to provide strength, permanence, and efficient, low-cost service. The reflectors, when used with either the manufacturers large or small heads,

are applicable to intersection, and various residential applications where a Type V light distribution pattern is desirable. They are designed for 7-in. incandescent light center lamps emitting 2,500 through 10,000 lumens.

Reflectors are offered with G-type collar for use with standard NEMA small metal or porcelain heads, or a pressure latch (illustrated) for use with standard NEMA large metal heads.

Line Material Co, Milwaukee 1, Wisc.

Cable-Splicing Mold

The use of a cable-splicing mold reportedly reduces time required for a permanent splice on power cable to approximately 15 min.

After cable ends have been joined, a split transparent acetate butyrate mold is placed over the cable and pressed together using the pressure sensitive adhesive provided on either half of the mold. The entire unit is made watertight by sealing the ends of the mold to the cable body with ordinary tape. An insulating resin compound, poured into the top of the mold, provides a weatherproof seal.

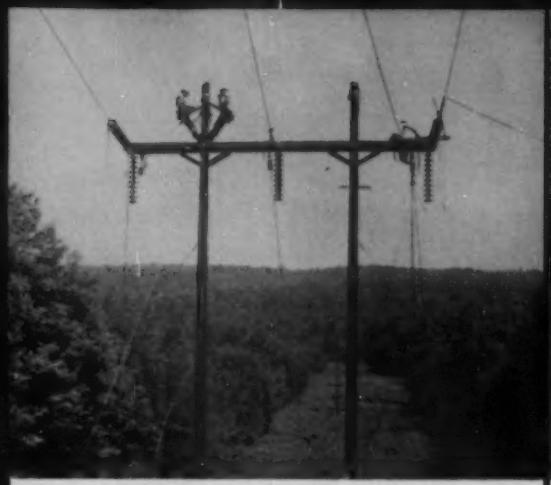
Several molds have been developed for 12-in. straight splice, branch joints and end caps.

Nordic Plastics Corp, 383 Douglas St, Brooklyn 17, N. Y.

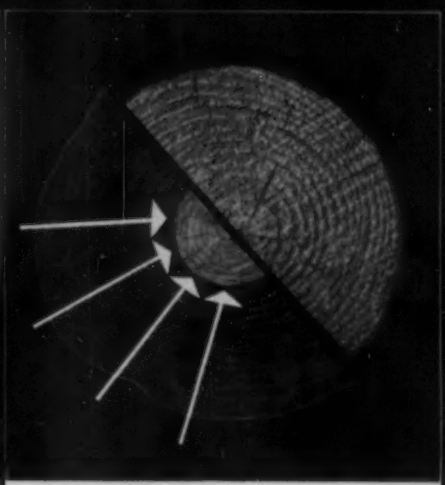
(*More New Equipment on page* 142)

Another utility case history

Clean Penta-preserved poles won't stain or bleed



PUBLIC SERVICE CO. OF NEW HAMPSHIRE specifies clean Penta protection for western red cedar poles, Douglas fir crossarms. Since 1951, this company has used Penta-treated wood to resist decay and wood-boring insects. Penta gives wood installations at least 4 times longer life.



PENTA GOES DEEP! Cross-section of two poles—Penta-treated at left, untreated at right—shows depth of Penta penetration. Penta effectiveness is as high after 20 years as it is after one month. Penta provides lasting economy!

PENTA PROTECTS WORKMEN, TOO! Penta stays put, will not bleed or leach out of wood. Penta-treated wood is clean, does not "burn" hands or stain clothing and, when properly treated, it is odorless.

SPECIFY PENTA for POLES, CROSSARMS, TRANSFORMER PLATFORMS, BRACES, CONTROL BOXES, PLANKING. More than 85 treating plants will apply Penta for you. Write us for this list, and for "Poles and Crossarms" booklet. Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478-T-7, St. Louis 1, Missouri.

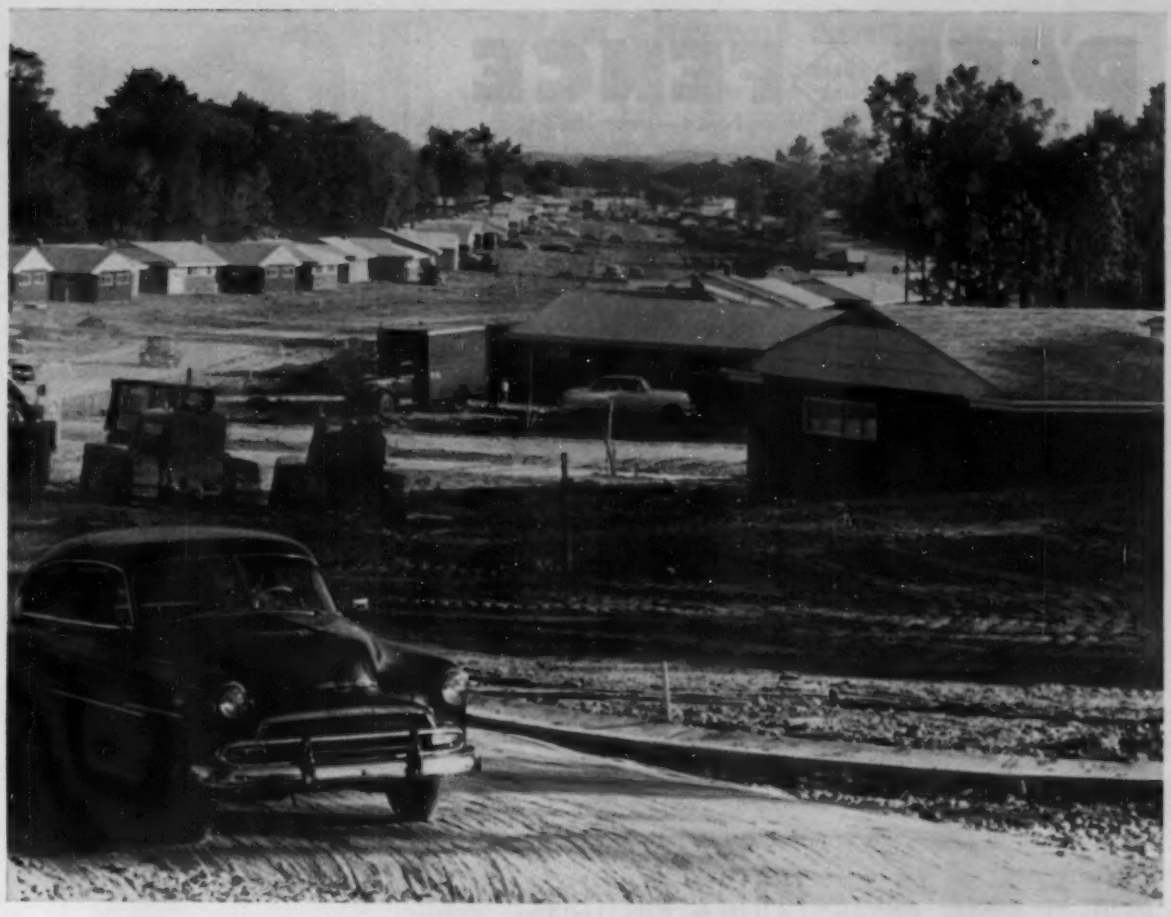
MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY WHICH SERVES MANKIND

In wiring multiple-unit developments, make the most of the load building potential and electrical adequacy of 100-ampere service.

Rome Type SE, Service Entrance Cable connected to typical overhead services through weatherhead to meter. Beyond meter, Type SE is approved for range or water heater connections.

Uniformly annealed and stranded copper. Approved by Underwriters' Laboratories, Inc., for 75° C. operation in wet or dry locations. 3 AWG, Type RH-RW, rated at 100 amperes under the 1953 National Electrical Code.



Now . . . housing can have 100-ampere service *with savings up to 15%* in cable cost

New home owners today want modern appliances and lots of them. Many want electrical home conditioning. This builds electric utility loads . . . but only if the wiring is adequate.

Today's recommended minimum service, for new construction or modernization, calls for 100 amperes. Rome's new and improved Type SE Service Entrance Cable provides such adequacy with possible savings in cable cost running as high as 15%. The answer lies in the use of a smaller conductor size, resulting in lower purchase cost, economy of handling.

Underwriters' Laboratories approval of Type SE, Service Entrance Cable, when insulated with Type RH-RW compound, for 75° C. operation makes possible the use of 3 AWG copper conductors instead of 2 AWG for 100-ampere service when voltage drop is not a factor. Here, then, is the opportunity to provide service adequacy with the inducement of lower cost to the home owner.

Approved for dry or wet locations

Further, Rome's new 100-ampere Service Entrance Cable is Underwriters' approved for 75° C. operation in, either, *dry or wet locations*. Its construction utilizes a moisture seal of reinforced rubberized tape under the weather-resistant outer braid. This, in effect, puts the assembled conductors in a "dry location," enabling the same approval as in the case of Type RHW insulation. For easy and positive identification, it is surface printed "SE—Style—U 75° C." In addition, the moisture seal provides added protection against the cutting of clamps and other fittings.

Installation advantages of Rome 3 AWG Type SE

Its lighter weight makes handling easier.
It is neat.
Its clean, gray finish can be painted to blend with the house.
It can be installed from weatherhead to meter . . . and beyond, for range and water heater connections.
It is cheaper.

Electrical contractors and utility power sales managers, alike, will find Rome's new 3 AWG—100-ampere Service Entrance Cable a boon to the promotion of adequate services for modern electrical living.

It Costs Less to Buy the Best

ROME CABLE
Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA

PAGE chain link FENCE

America's First Wire Fence—since 1883

• When you think of hazards at your properties, think of PAGE. And when you think of protection against hazards, think again of PAGE. Whether you choose heavily galvanized Copper-Bearing Steel, corrosion-resisting Aluminum, or long-lasting Stainless Steel, PAGE Fence is quality controlled from raw metal to rugged fence erected on metal posts deep-set in concrete. Available are 8 basic styles, varied by heights, types of gates, top rails, and barbed wire strands for added security. Finally your PAGE Fence will be expertly erected by a reliable, technically trained firm. For important fence data and name of nearest PAGE firm—

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

PLM Type AC 600-v Terminator for armored cable

happy ending

FOR ARMORED CABLE RUNS

TERMINATORS from PLM

Type ACS Terminator for installations to 15 kv

Type BAC Bracket for wall or ceiling mounting

• Planning is easy...installation easier...with armored cable fittings from PLM! PLM Terminators are made for installations to 15 kv...in cast aluminum or bronze...eliminate need for bulky, costly potheads in many applications. PLM Unit Package Kits speed up the job, too...insure correctly designed terminations and splices at every point.

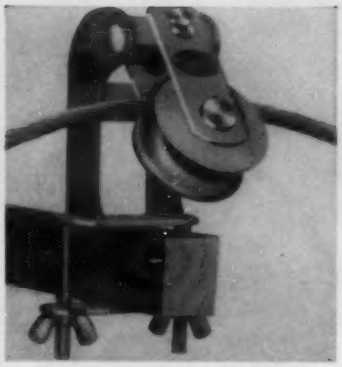
Put PLM in your plans for quick action on both standard and special needs. Write for catalog.

PLM Products, Inc.

3873 West 150th St. • Cleveland 11, Ohio

WIRE AND CABLE FITTINGS AND ACCESSORIES

Armored Cable Terminators • Splicing and Terminating Kits • Conduit Ventilators



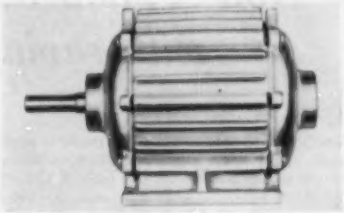
Cable Stringing Blocks

This block and bracket combination, for stringing wire on curves, holds conductors at about insulator height to facilitate sagging back.

The block, which opens for threading, is positively locked when closed. Other features are a full universal head to assure alignment with direction of pull and a stop on uprights to prevent excessive back-swing of block.

Construction is of fabricated steel with pressure-cast aluminum alloy sheaves. Blocks are offered in 5 and 7-in. sheave sizes and will accommodate conductors up to 2-in. diam. The base fits all standard size distribution crossarms.

Campbell Specialty Co, 1604 W. 4th St, Okmulgee, Okla.



Fan Motors

Totally enclosed motors, ¾ to 20 hp, are designed for use on fans, unit heaters and cooling towers.

The Type EFD features double width prelubricated sealed bearings and deep fins for better heat dissipation. Windings are double-heavy Formvar (Polyvinyl-acetal insulated) wire.

A Type EXFD motor is offered for hazardous locations.

Lima Electric Motor Co, 39 Findlay Rd, Lima, Ohio.

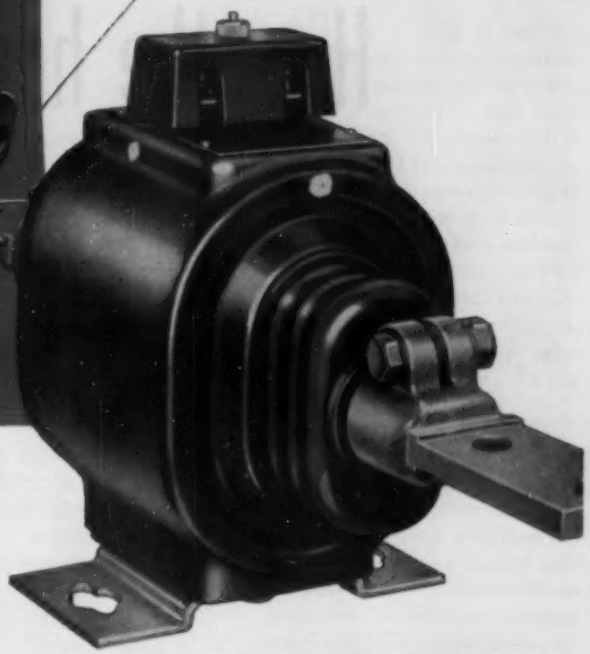
(*More New Products on page* 146)

New Current Transformer

"Do-It-Yourself" Kit Solves Stocking Problems

EXTRA LARGE OPENING of 600-volt through-type transformer makes possible easy conversion.

KIT CONTAINS insulated primary conductor, two primary bushing inserts, and two primary terminals with gaskets. Complete instructions make changeover easy.



New "do-it-yourself" kit converts a through-type 600-volt indoor-outdoor current transformer into a bar-type 5000-volt current transformer for either indoor or outdoor use. You get two voltage classifications, four possible uses from a single current transformer. The changeover is easy. Complete inserts and instructions come in a handy kit. You need only one unit in stock for two uses of two voltage classifications. Best of all, by using this kit on a 600-volt unit, you can cut cost of 5-kv metering.

Heart of this cost-cutting, stock-saving idea is Allis-Chalmers molded epoxy resin through-type 600-volt current transformer. It is available for 200-5, 400-5, 600-5 and 800-5 amp ratings, performing satisfactorily up to 200% continuous current. Its large opening is sufficient to take inserts that convert it for 5000-volt service.

Get full information on how you can take advantage of this completely new idea for cutting costs, saving on stocking. See your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wis.

A-4744

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Laugh at the sun!
Thumb your nose at Old Man Winter!
Have pushbutton weather without pushing a button.
It's the hottest thing to hit the utility market since they chucked out the old ice-box
... within 10 years, a shoo-in to revolutionize the air-conditioning business.
You'll see why when you read . . .

How the heat pump turns the

Who'd have believed you could heat a house with a refrigeration unit? Who could envision a reverse cycle, no fuel or flame . . . a single appliance to condition the air, from dog days through the dead of winter?

The electric power people could! And in 9 short years they've brought the engineer's dream to commercial reality. Today it's the latest word in all-electric living . . . by 1965 there'll be a million heat pumps operating . . . they're getting set right now to zero in on 50 million prospects. And they're banking on Electrical World to help . . .

tables on nature

For equipment makers know World's leadership in communicating new developments . . . in analyzing costs and efficiency, in interpreting trends . . . in welding the overlapping interests of utilities, consultants, electrical manufacturers and large industrials.
Electrical World alerted the industry on heat pump possibilities back in 1946 . . . since then, it's carried 165 editorial columns on this one subject . . . last year, the major part of a whole issue was devoted to the heat pump's progress, engineering techniques and practical market development.

So, too – *in every issue* – World presents the truly significant news and engineering advances for men concerned with generation, transmission, distribution and utilization of electricity. Here, in an industry that's doubled itself within 10 years, that's spending $50 billion within the next decade for new plants and equipment, is the one magazine read, respected and *voted 4 to 1 the "most useful" by your own customers and prospects.* But let us prove it . . . Electrical World is the only publication serving all the electric power industry *completely!*

What in the Electrical World?

WHAT'S COOKIN'? . . . the fourth largest industry in the U.S. is cooking . . . and too darned much of it with gas, worse luck! An EW survey recently completed of the commercial cooking load shows that utilities are barely scratching the surface. This study of the 43 utilities leading in power sales to the food service industry reveals what they're doing to tap this total annual potential of 15 million Kw. Ask for "Commercial Electric Cooking"—no charge.

IT'S A TRICK to turn out quality editorial coverage in quantity. But EW's editors did it in '54 . . . will do it again in '55. The answer lies in numbers . . . 25 full-time editors on the move can stir up an awful lot of dust . . . dig up bushels of wanted information . . . create overwhelming reader preference — in EW's case, 4-to-1 or better over the second publication, in surveys conducted by manufacturers or agencies like yourself. Let us show you what you may be missing!

YOUR PROSPECTS interested in nuclear power? Then they're probably reading EW, which published *sixteen* articles on the subject over the past year. Two other technical magazines in the field published four, and one, respectively, according to a bibliography compiled and sent us by a manufacturer.

Remember . . . in the dynamic electric power industry, only World can do the World's* work.*

* **Electrical World**, *that is!*

A McGraw-Hill Publication • 330 West 42nd Street, New York 36, New York

• Preformed Line Guards will save money on short-span urban distribution lines . . . whether ACSR, all-aluminum, or copper conductors are in use. Use them on all conductors where protection against vibration damage is not essential and standard Armor Rods may not be needed. Line Guards are smaller in diameter—fit insulator grooves of both old and new designs. Check P L P price lists. You will notice Line Guards are *lower* in price than Armor Rods . . . yet, Line Guards provide sufficient protection on short spans.

Line Guards . . . developed from Armor Rods—are used like Armor Rods . . . protecting conductors against arcover, chafing, and mechanical wear due to concentrated stresses on light or short-span construction.

Let your P L P Representative help you select the most economical P L P Product for your application. Write or call Cleveland: EX 1-3571.

**Made in accordance with or for use under one or more of the following U. S. Patents: 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.*

Pin Insulator
Line Guards should be used over the conductor where tie wires are applied . . . guard against tie-wire dam-
Line Post
Line Guards permit you to apply your ties as tightly as needed without fear of conductor damage.
Clamp Type
Line Guards fit snugly . . . cushion the conductor from clamp-pressure damage and

PLP **PREFORMED LINE PRODUCTS CO.**
6349 St. Clair Avenue
Cleveland 3, Ohio

MORE NEW PRODUCTS

Esterline-Angus Co, Inc, Box 596, Indianapolis 6, Ind., has a combination of rectifier **ac ammeters** and a split-core current transformer with a 50 ma secondary which provides ranges of 0-25/50/100/200 amp, 25-400 cps. Details in Bulletin No. 455.

Greibach Instruments Corp, Metuchen, N. J., offers a precision ohmmeter and **megohmmeter** for measuring high resistance values to a fraction of 1%. Meters have a zero adjustment that compensates for varying battery voltages. They are built with three ranges of 3, 10 and 30 megohms at mid-scale.

G. W. Galloway Co, 25 N. 4th Ave, Arcadia, Calif., offers a mobile **hydraulic lift** known as the "Bulb Snatcher" that can lift men and materials weighing up to 400 lb to a height of 20 ft.

Edwin L. Wiegand Co, 7500 Thomas Blvd, Pittsburgh 8, Pa., offers a flexible brass **conduit lead wire** enclosure for mechanical protection of electric cartridge heater lead wires. Enclosure is available on cartridges in a full range of lengths and wattages for ⅜, ½, ⅝ and ¾ in. diam heaters.

Diehl Mfg Co, Somerville, N. J., has a 35-w, 2-phase, ac **servomotor-tachometer** that operates on 60-cps to regulate motor speed or to stabilize closed-loop circuits.

General Electric Co, Schenectady 5, N. Y., has:

A 1,000-amp **germanium plating rectifier** that features compactness and light weight, high conversion efficiency, and a minimum number of moving parts.

An aluminum **traffic signal** that weighs 45% less than existing models.

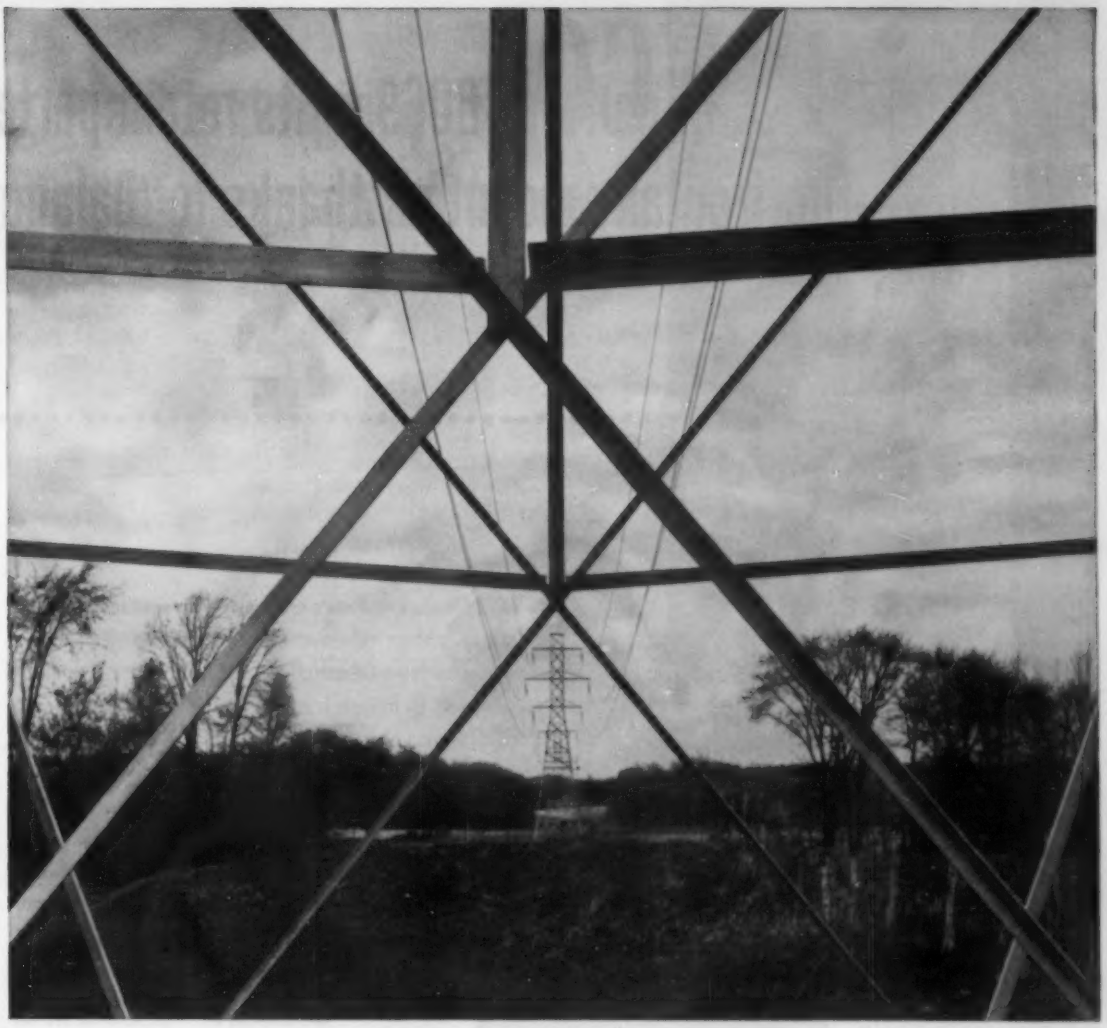
Type WD20Ag, 200-amp **engine driven welder** which is NEMA-rated for a current range of 40-250 amp. It will handle all dc or ac/dc electrodes from ⅛ to ¼ in.

A general-purpose **oscillograph** that will record up to 71 variables on one oscillogram when combined with transducers and amplifiers for the measurement of pressure, vibration, strain, flow, etc.

Incorporated the use of spring-

(*Continued on page* 150)

DOW



from a maintenance point of view . . .

Dow brush killers come out ahead in low cost right-of-way vegetation control

When you're juggling a maintenance budget, you want results you can measure in terms of cost per mile or acre. In right-of-way vegetation control, you look for low costs and simplified upkeep. You look for special-purpose brush and weed killers designed to do specific jobs at minimum cost. You find all these advantages in Dow brush and weed killers.

Write us for technical information and assistance on the use of Esteron® 245, Esteron Brush Killer, Esteron Ten-Ten and 2-4 Dow Weed Killer, Formula 40 for low-cost, progressive brush and weed control. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan.

you can depend on DOW AGRICULTURAL CHEMICALS

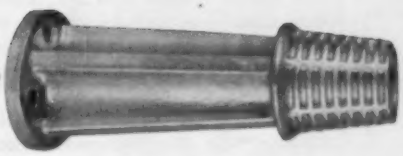
DOW

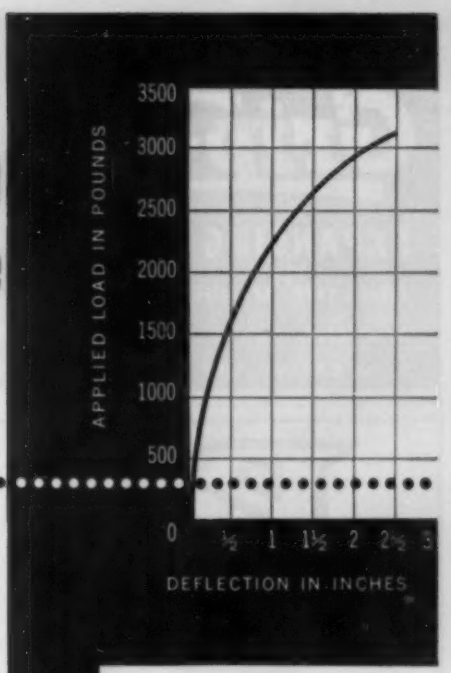
• PINCO L-6069 units retain perfect horizontally mounted..thanks to "balanced

Here's dramatic evidence of the perfection of Pinco's "Balanced Design" of porcelain and hardware. Even under the combined weight of two men, this stack of Pinco 6069 units remains in perfect alignment. Thus, the rigidity of these units in service, assures accurate switch operation at all times. Another reason why utilities have found that

it pays to put up Pinco!

alignment and rigidity even when design" of porcelain and hardware





A study of this deflection curve shows the rigidity of Pinco 6069 Switch and Bus Units under various loads. And the secret of Pinco's perfect alignment even when horizontally mounted lies in the balanced design of the porcelain and hardware . . . with added rigidity and strength made possible through the use of a specially designed, ribbed malleable iron pin to prevent deflection.

Because of extreme accuracy of assembly it is never necessary to "shim" Pinco L-6069 units. In installations from coast-to-coast, they have PROVED that they're RIGHT *for* the job . . . always RIGHT *on* the job! You'll be SAFE with Pinco L-6069's, too!

For complete mechanical and electrical specifications on Pinco Switch and Bus Units from 7½ KV to 330 KV, refer to Pinco Catalog No. 49, pages 113 and 123.

The Porcelain Insulator Corporation
LIMA, NEW YORK

PINCO INSULATORS

1920 35 1955 YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

Suspension Insulators . . .
Clamps and Fittings
. . . Switch and Bus Insulators . . .
Distribution and High Voltage Pin Types . . .
Guy and Tree Insulation . . . Special Porcelain.

SPECIFY

Grip-Tite

EXPANDING ANCHORS

GRIP-TITE MANUFACTURING CO.

WINTERSET, IOWA "Pioneers in the Anchor Field"

IN CANADA: LINE AND CABLE ACCESSORIES, LTD. • TORONTO

Remember . . . in the dynamic electric power industry, only World® can do World's® work . . . **Electrical World** that is . . .

free

send for this catalog describing acker's new all-purpose digger

Send the coupon today for your copy of our new catalog showing the wide range of application as well as the many exclusive features that make the Acker All-Purpose Digger the most versatile and useful you can buy!

TWO MODELS TO CHOOSE FROM — Jeep mounting with compact, power take-off or skid-mounted with self contained power plant for truck mounting.

ACKER DRILL CO., Inc.

725 W. Lackawanna Avenue, Scranton, Penna.

Please send me free copy of Bulletin 40. EW.

Name_____ Title_____

Firm_____

Street_____

City_____ State_____

More New Products

(*Continued from page* 146)

mounted jewels on all **portable indicating instruments** to prevent blunting of pivots due to jarring of the instrument.

A rapid-start, **fluorescent lamp ballast** that is said to be smaller in size and approximately one-third lighter than previous models.

Thomas & Betts Co, 36 Butler St, Elizabeth, N. J., has extended its liquid-tight **connector line** to accommodate flexible conduit with 2½, 3 and 4-in. diam. Line includes straight, 90 and 45-deg elbow sections for use on EF type liquid-tight raceways.

Adre Co, Route 1, Box 38, Hales Corners, Wisc., has developed an electrical **contact burnisher.** Fitted in an insulated pen-type case, the burnishing element, a micro-fine surface, gives mild, abrasive action.

Blackhawk Industries, Dubuque, Iowa, has introduced a slip-fitter **service entrance head** that needs neither pipe-threading nor slip-fit adapters. The product is now available for 1¼-in. conduit.

Crouse-Hinds Co, Syracuse, N. Y., has designed an observation **light conduiet** (Type V) for use inside metal tanks and kettles. The vapor-tight, heat-resisting glass globe is available for use with 50, 60, 75, and 100-w lamps.

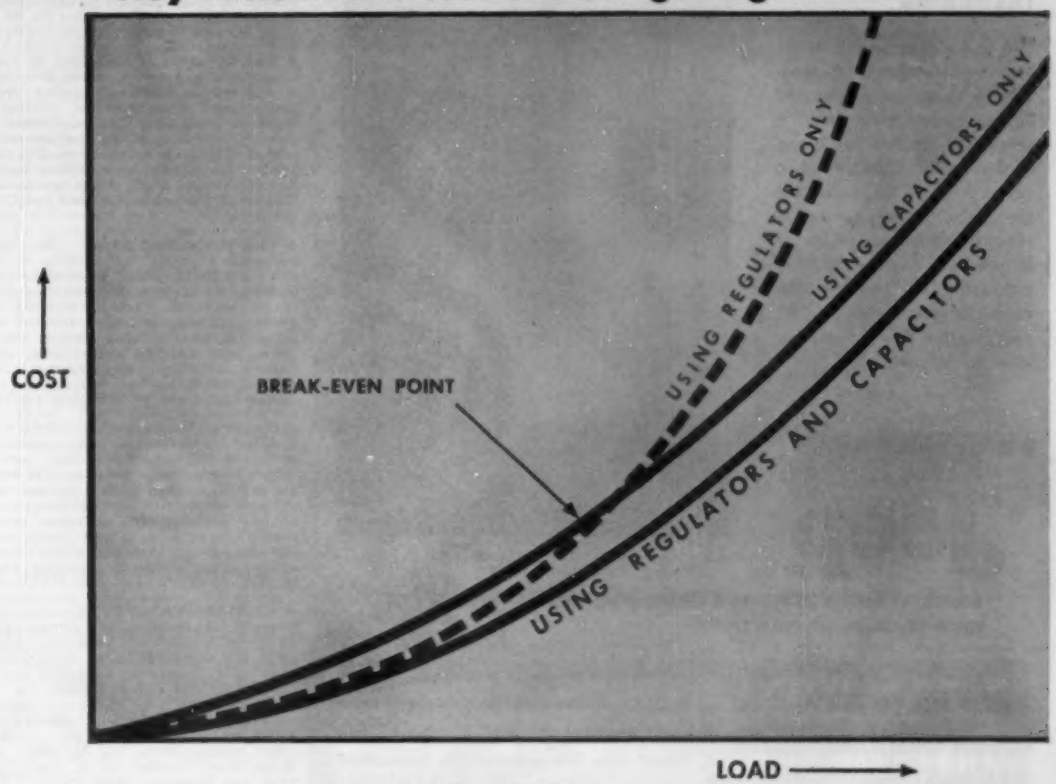
Insulation Manufacturers Corp, 565 W. Washington Blvd, Chicago 6, Ill., offers **fibre wedges** with Mylar film bonded to the inside of the wedges in any of ten standard square-formed sizes, the eleven curved-formed sizes or any special sizes.

Martindale Electric Co, 1371 Hird Ave, Cleveland 7, Ohio, has the Type B-1-M **growler** with adjustable jaws (2½ in. face length) for testing armature coils from 1 to 18 in. diam.

Jefferson Electric Co, Bellwood, Ill., is making a line of "rugged duty" **transformers** for machine tool control panels. Ratings range from 50 to 1,500 w in three types. Voltage ratings are: 230/460-115 at 60 cps, 575-115 at 60 cps and 230/460/575-115-95 at 50/60 cps.

OPERATION VOLTAGE REPORT NO. 3

Key facts in the cost of voltage regulation



Conclusion: AT ANY LOADING....

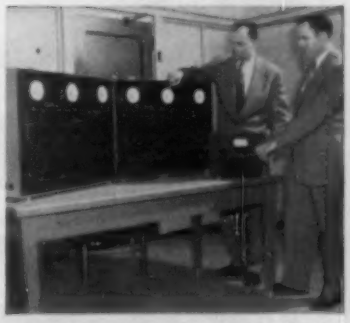
REGULATORS PLUS CAPACITORS COST LESS

A critical examination of the functions of feeder voltage regulators and shunt capacitors reveals that each has particular benefits prescribing their use. Hence, when using these equipments together, the individual advantages complement each other to give the best voltage control and increased load capability.

The important question then becomes, "How do the costs compare?" It can be seen in the figure above that, at light loads, the use of voltage regulators alone is more economical than capacitors alone. Conversely, at heavier loads past the "break even" point, capacitors are more economical when used exclusively. But, at *all* loads, the combined use of these equipments represents the least expensive method of proper voltage control.

When system parameters, loadings, costs of equipment, and evaluated losses change—the result remains the same. Regulators and capacitors used together not only provide superior voltage control and greater load capability . . . but do it at less cost.

This is the third in a series of reports describing the results of a comprehensive study of voltage on feeders. For a complete discussion, contact your G-E Apparatus Sales Engineer. General Electric Co., Schenectady, N. Y. 045-3



Portable demonstrator being used by G-E Engineers R. M. Butler and D. R. Samson to show effect of capacitors and regulators under variety of feeder load conditions.

GENERAL ELECTRIC

4-wheel-drive does another job better!

TRENCHING

This 'Jeep'-propelled trencher digs trenches up to 6 feet deep and 14 inches wide. Mounted on the 4-wheel drive 'Jeep', it gets to the job in a hurry, and speeds up the laying of pipe, cable or drain tile. Traveling speedily to the job, the unit is ready for trenching in a matter of minutes. Greater mobility makes the 'Jeep' trencher profitable for short trenches. See your nearest Willys dealer or write for information.

4-WHEEL-DRIVE UNIVERSAL

'Jeep'®

A member of the 'Jeep' family... world's largest-selling 4-wheel-drive vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

Save up to 85%

brush handling costs

M & M Brush Grinder rapidly converts brush to chips and reduces piling, trucking, and burning costs.

Cut labor and truck operating costs as much as 85%. M & M Brush Grinder chews brush and branches up to 6" in diameter into small chips and automatically blows them over the ground or into a truck. Compact, portable unit with its own power plant. Haul it right to the job by jeep, or truck. Fully enclosed mechanism is protected from dust and dirt and completely safe. Sturdy construction for long, satisfactory service. Write today for illustrated folder.

MITTS & MERRILL 1002 South Water St. • Saginaw, Michigan

85

CATALOGS–BULLETINS

● **WELDING EQUIPMENT:** Manual and automatic welding equipment, accessory apparatus and welding wire are the subject of 16-page illustrated Catalog 2350. Schematic diagrams and specifications are included. Air Reduction Sales Co, 60 East 42nd St, New York 17, N. Y.

● **PANEL INSTRUMENTS:** A line of ruggedized and sealed panel instruments is covered in 12-page Catalog A-38-B. Dimensional diagrams and photographs illustrate ac, dc, rectifier type and thermo instruments in commercial and military types ranging from 1½ in. to 4½ in. Design and construction features, test procedures and ratings are included. Weston Electrical Instrument Corp, Newark 5, N. J.

● **PROGRAM CONTROL:** The use of automatic control instruments to carry out a predetermined processing or testing schedule on a time and conditions basis is discussed in 24-page Bulletin 1130. Charts and diagrams are included in descriptions of program control selection, types of program controllers, typical process programs and instrumentation. Minneapolis-Honeywell Regulator Co, Industrial Division, Philadelphia 44, Pa.

● **NYLON MOLDING COMPOUND:** Molding characteristics and physical properties of Plaskon Nylon 8200 are presented in an 8-page booklet. The ease of moldability, relatively low molten viscosity and controllable crystalline structure of this thermoplastic material are discussed. Tabular data and charts are included. Barrett Division, Allied Chemical & Dye Corp, 40 Rector St, New York 6, N. Y.

● **STAINLESS STEEL:** Properties, specifications, applications and design data on 20 grades of stainless steel wire, rod and strip are described in an illustrated 40-page design handbook. Chapters deal with the selection of stainless steels for corrosion resistance, heat resistance, mechanical properties and spring properties. Properties charts, size and weight charts, and other tabular data are included. Alloy Metal Wire Division, H. K. Porter Company Inc, Prospect Park, Pa.

● **SECONDARY DISTRIBUTION SYSTEMS:** Higher voltage distribution systems for secondary networks in commercial buildings is the subject of a 24 page bulletin (GEA-6223). The bulletin explains the principles underlying 480Y/277-v distribution systems and points out economies in both original investment and operation by comparison with conventional systems. Advertising & Sales Promotion, Distribution Assemblies Dept, General Electric Co, Plainville, Conn.

● **STAINLESS TUBING:** Bulletin TB-355, 6 pages, describes seamless, stainless tubing and pipe. Included are tables of analyses, mechanical properties, creep strength, physical properties and oxidation resistance of nine types of stainless tubing steels. Tubular Products Division, Babcock & Wilcox Co, Beaver Falls, Pa.

● **VOLTAGE REGULATORS:** Bulletin OSR-1 outlines how voltage problems can be solved simply by the installation of one-step regulators. It tells how to determine regulator location and describes regulators rated from 2.4 to 7.62 kv. RT&E Co, 632 N. Eighth St, Milwaukee 3, Wisc.

● **TRANSFORMERS:** Single and three-phase core form power transformers are described and illustrated in 24-page Catalog 4455. Included are photographs of installation and construction methods; drawings of transformer components and features; and descriptions of electrical and mechanical design and construction, and accessories. Pennsylvania Transformer Co, Canonsburg, Pa.

● **AUTOMATION:** The subject of a 16-page brochure is automation in the petroleum and chemical industries. Data reduction systems, electronic instrumentation, stream analyzers and high pressure instruments are covered. Diagrams illustrate the basic functions of instruments used in automatic control. M. W. Kellogg Co, 225 Broadway, New York 7, N. Y.

● **ELECTRICAL CONDUCTORS:** A 10-page brochure pictures and describes facilities of an electrical conductor research laboratory. Kaiser Aluminum & Chemical Corp, 1924 Broadway, Oakland, Calif.

● **BEARINGS:** Up-to-date technical information and illustrations of a complete line of ball and roller bearings, ball bearing pillow blocks and flange cartridge mounts are contained in 52-page Bulletin A-638. Tabular data includes engineering drawings, dimensions, shaft sizes, weights, radial load ratings and list prices. Dodge Manufacturing Corp, Mishawaka, Ind.

● **LAMINATED PIPE:** Physical and chemical properties of a line of laminated fluorcarbon resin pipe are described in a 4-page bulletin. Specifications, applications, and a description of flanging and coupling pipe are included. Resistoflex Corp, Belleville, N. J.

● **STEAM GENERATORS:** A 16-page catalog, titled "Packaged Steam Generators," gives capacities, dimensions, construction features, instrumentation, accessories, sectional drawings, and installation photographs of generators with steam capacities from 10,000 to 46,000 lb per hr. Foster Wheeler Corp, 165 Broadway, New York 6, N. Y.

TECHNICAL LITERATURE

MAGNETIC ALLOYS—Current finishing techniques applied to magnetic materials such as silicon-iron, nickel-iron and aluminum-iron alloys are covered in an 8-page bulletin. The booklet discusses design and operation of modern, high-precision processing equipment, including rolling mills, gang slitters and roller levelers. Stanat Mfg Co, Inc, 47-28 37th St, Long Island City 1, N. Y.

CORROSION—"How Zinc Controls Corrosion" is a 32-page booklet describing the ways in which zinc lengthens the life of steel products, and reduces maintenance costs. Drawings, charts and photos cover the control characteristics of zinc coatings, zinc pigments, and zinc anodes. American Zinc Institute, 60 E. 42nd St, New York 17, N. Y.

PARALLEL REGULATION—Booklet No. GET-2472 describes and illustrates the paralleling of regulator equipment by modified compensator setting to prevent regulators from "misreading" and over-correcting the true load voltage. General Electric Co, 1 River Rd, Schenectady 5, N. Y.

WELDING—An enlarged edition of "Specifications for High Tensile and Low-Alloy Steel Covered Arc-Welding Electrodes" classifies electrodes by chemical analysis in addition to the usual classification by mechanical properties. AWS A5.5, as it is designated, also provides details on test methods, test requirements, standard sizes and lengths, packaging and marking. Price 40¢ American Welding Society, 33 W. 39th St, New York 18, N. Y.

ENGINEERING STANDARDS—Proceedings of the Third Annual Meeting of the Standards Engineers Society stresses cooperation of government and industry in work on standards. The 48-page document also discusses the place of standardization in management, and suggestions on how to set up and operate a materials department. Price $3.00 Standards Engineers Society, Box 281, Camden 1, N. J.

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No matter how rough the going—when you need to get men and equipment to the line in a hurry, you can count on the 'Jeep' Truck. The extra traction of its 4-wheel drive takes it off the road to follow telephone lines, regardless of terrain or weather conditions, and it carries the equipment needed for emergencies resulting from storm or other causes. See your nearest Willys dealer or write for information.

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All-Electric HEATERS
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For more than a quarter century Electromode has concentrated on one specific enterprise—Heating by Electricity. Continually expanding its line to serve modern heating methods, Electromode has the most complete selection of electric heaters and electric heating systems available today.

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Only Electromode has the completely sealed-in, cast-aluminum heating element. No danger of fire, shock or burn. Automatic safety switch prevents overheating. The heating element is guaranteed for five years against any defect in material or workmanship.

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Explosion-Proof for hazardous areas

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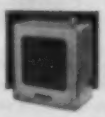

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MODEL	C-1	C-3
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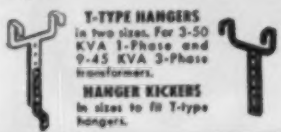
WEIGHT	46 lbs.	100 lbs.

● Thiel Hangers are made according to NEMA specifications—heavy gauge steel construction, hot-dip galvanized for dependable service and long life. Two styles complete with galvanized bolts and nuts. In stock for immediate delivery.



T-TYPE HANGERS in two sizes. For 3-50 KVA 1-Phase and 9-45 KVA 3-Phase transformers.

HANGER KICKERS in sizes to fit T-type hangers.

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Ankoseal
ALL-PLASTIC
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cables

1. provide distribution circuits
2. deliver power to homes
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BOOKS

Books Received Since June 8, 1955

Magnetic Materials in the Electrical Industry. By P. R. Bardell. Published by MacDonald & Co, Ltd. London, W. 1. England, 288 pages, illustrated. Price 32s 6d.

Symposium on Methods of Testing Building Constructions. Published by the American Society for Testing Materials, Philadelphia 3, Pa. 136 pages, illustrated. Price $2.75.

Compilation of ASTM Standards in Building Codes. Published by the American Society for Testing Materials, Philadelphia 3, Pa. 973 pages, illustrated. Price $6.00.

Connecting and Testing Direct-Current Machines. By F. A. Annett and A. C. Roe. Published by McGraw-Hill Book Co, New York 36, N. Y. 313 pages, illustrated. Price $5.00.

Power Plant Management. By Robert Henderson Emerick. Published by McGraw-Hill Co, New York 36, N. Y. 339 pages, illustrated. Price $6.50.

The Commissioning of Electrical Plant. 3rd Edition. By R. C. H. Richardson. Published by Chapman and Hall, Ltd. London, England. 440 pages, illustrated. Price 30s Net.

Electro-Technology. By M. G. Say. Published by Philosophical Library, Inc. New York 16, N. Y. 167 pages, illustrated. Price $6.00.

Horner's Dictionary of Mechanical Engineering Terms—7th Edition. Revised by Staton Abbey. Published by Philasophical Library, Inc., New York 16, N. Y. 417 pages. Price $6.50.

Lignes Electriques T.H.T. By H. Carpentier. Published by Editions Eyrolles, Paris, France, 250 pages, illustrated. Price 4.800 Fr.

Experimental Electronics for the Beginner. By Leonard R. Crow and Lewis G. Blevins. Published by Universal Scientific Co. Inc, Vincennes, Ind. 70 pages, illustrated. Price $3.50.

TV Engineering

Television—2nd Edition. By V. K. Zworykin and G. A. Morton. Published by John Wiley and Sons, Inc., 440 4th Ave, New York 16, N. Y. 1,049 pages, illustrated. Price $17.50.

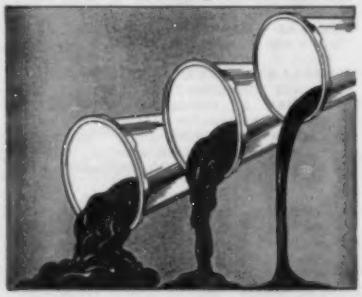
Fourteen years have passed since the 1st edition of this book. Engineering advances during the interim have been so rapid that many chapters have been completely re-written. And full coverage of color TV adds nearly 200 pages.

Part 1 discusses the physics of TV, including new semi-conductors, photoconductors, photoemitters, and phosphors. Part 2 sets up system fundamentals and development leading up to today's transmitters and receivers in Part 3. Color and industrial TV comprize the bulk of Part 4.

Until recently such a comprehensive treatise would be limited in utility use to the few engineers concerned with TVI problems. But recent applications of industrial TV techniques include remote observation of boiler combustion and other system operations; designers and operators of these installations will also find valuable assistance in this book.

METER DEVICES COMPANY
1091 Prospect Ave. S.W.
CANTON, 6, OHIO

Insulating and Cable-Pulling
COMPOUNDS
of Record-Breaking Performance



Mineralac gives you a complete assortment for every need: dense, viscous and fluid consistencies for high and low voltages in cable-joints, pot-heads, terminal bells, distribution cables, street lighting, telephone work. . . . Insoluble in oil or water, for all temperatures. Clean, safe, economical—outranks all others in quality.

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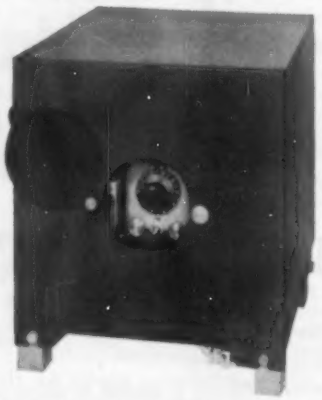
Get continuous, instantaneous records of system frequency and time deviation

... with this new *ElectroniK* instrument



NEW TIME DEVIATION DETECTOR

is practically error-proof

In this precision-built element, there are two synchronous motors. One is driven by line frequency, the other by standard frequency from the system's time standard. Both motors are geared to a differential mechanism. As long as both frequencies are identical, the differential stays stationary. When one motor goes faster than the other, the differential's floating spider begins to turn . . . its speed depending on the frequency difference. A Helipot slidewire connected to the spider transmits a d-c voltage determined by the spider position. This voltage, recorded by the *ElectroniK* instrument, is directly related to the system time error.

Precision-cut gears and ball-bearing mountings reduce friction to a minimum. Gears run in an oil bath . . . require no lubrication service.

★ **separate measuring systems:**

two independent pens, driven by separate "Continuous Balance" measuring circuits—one for frequency, one for time deviation. Dual scale calibration facilitates readings.

★ **continuous recording:**

every change in time deviation is measured and immediately recorded; no significant variations can go unnoticed. Continuous line record shows trends clearly.

★ **full-scale travel of both pens:**

both the frequency and time deviation ranges extend across the full width of chart and scale . . . afford maximum resolution of readings.

★ **shows accumulated time error:**

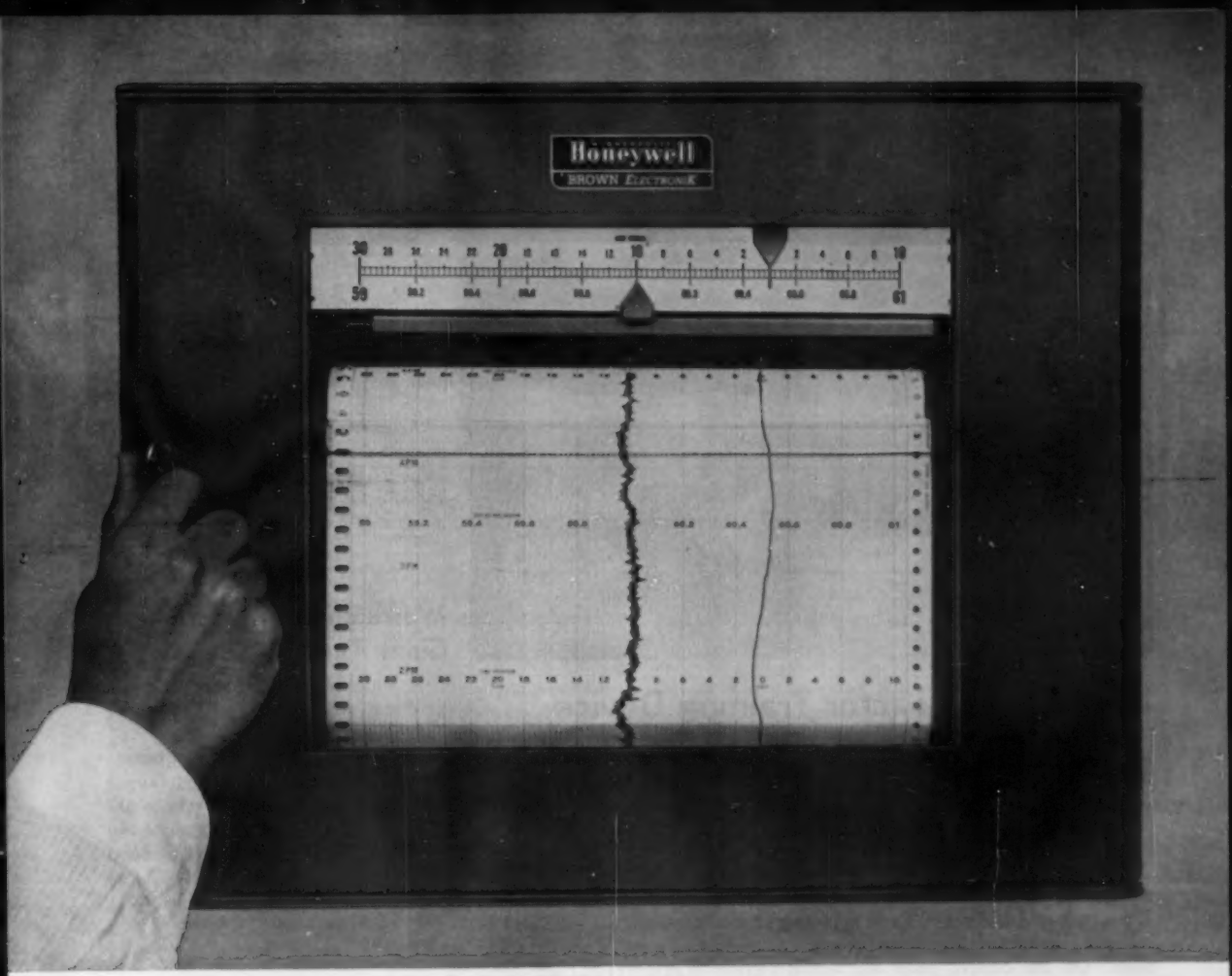
reads directly in seconds the total deviation between generator frequency and the system's standard time source.

★ **high accuracy:**

new time deviation detector and *ElectroniK* system together have precision within 0.1 second, exclusive of any error in the time standard. Accuracy of the frequency measuring system is within ±0.01 cps; measuring circuit can detect frequency changes as small as 0.005 cps.

★ **stays in synchronism:**

the recorder can be shut down temporarily for inspection of routine service without losing integrated time measurement. As soon as the recorder resumes operation, it reads total deviation correctly.



Now, system operators can have a more accurate and readable record of time deviation before them as a guide to correction of system time error. The new *ElectroniK* Time Deviation Recorder instantaneously measures and records both time error and frequency on the same chart. Each of these important variables is continuously drawn in readily legible detail—with a degree of dependability never before achieved.

The instrument embodies two separate "Continuous Balance" measuring systems . . . each operating a separate recording pen. The frequency system employs the improved pulse type measuring circuit based on *ElectroniK* components that have been in use in power plants for many years. For measuring time deviation, an entirely new detecting method is employed which offers exceptional accuracy and reliability . . . working with the industry-proved *ElectroniK* potentiometer.

Your load dispatchers and station operators will be able to improve supervision of system frequency with this *ElectroniK* recorder. Our local engineering representative will welcome the opportunity to discuss your specific requirements . . . and he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA:** Write for Instrumentation Data Sheets Nos. 9.1-8a and 9.1-14.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

L&N Builds Reactor Training Device

Leeds & Northrup Co has built a nuclear reactor training device (illustrated) that simulates electrically the operation and control of a real reactor. This "Nuclear Reactor Simulator Assembly", as it is called, is designed to enable private organizations to teach reactor theory and practical operation when costly reactors are not available for this purpose.

The reactor model, made of plastic, is of the "swimming-pool" type. It has the familiar lattice reactor core, and control rods which move up and down in response to panel controls and operating conditions which are simulated by an analog computer. The device even provides the blue glow of the Cerenkov effect. On the control panel are actual recording instruments, amplifiers, meters, switches and other gear used to operate a real reactor.

L&N says assemblies can be supplied to simulate operation of other reactor types, including the Pool Type (light water modulated, enriched), the Graphite moderated natural uranium type, CP5 Type, U233 Thermal Reactor, and the PU239 Thermal Reactor.

The model shown will be displayed at the Instrument Automation Exhibit at Los Angeles from Sept. 12-16.

Du Pont Has New Insulation

A new family of insulation materials, reported to be highly resistant to solvents, oils, and refrigerants, is being produced in pilot plant quantities by E. I. Du Pont de Nemours & Co's fabrics and finishes department. Du Pont claims that the insulation makes it possible to use potentially inexpensive and chemically identical insulating materials throughout a motor.

"Lecton", as it is called, is an acrylic resin wire enamel. It is reported that glass fabrics coated with the resin and laminates of the coated glass fabric will withstand temperatures above the minimum required for Class B insulation (130C) for extended periods and can be used intermittently at temperatures up to 150C. Dielectric properties are essentially unaffected by high relative humidities, says Du Pont.

At present, experimental quantities of glass fabric coated with "Lecton" are being offered to electrical manufacturers in a 3 mil construction, 38-in. wide. Laminates of various thicknesses are also available in test quantities.

Simplex Splicing Booklet Can Be Wiped Clean

Something new in wire and cable splicing instruction pamphlets has recently been published by Simplex Wire & Cable Co of Cambridge, Mass. Their new instructions are printed on a plastic impregnated paper that may be cleaned with a damp cloth.

Another innovation is the use of many colors to identify the various steps in the splicing drawings. This use of color is an aid in understanding a somewhat complicated subject.

Westinghouse Is Building Giant Turbine-Generator

A super-critical pressure turbine-generator with a nominal rating of 325,000 kw (reported to be the world's largest and most efficient) is being built by Westinghouse Electric Corp. The turbine-generator, first scheduled as a 275,000 unit, will be installed in a new station being built by Philadelphia Electric Co at Eddystone, Pa.

Delivery of the unit is scheduled for 1958 with operations expected to begin in 1959.

NDA Changes Name, To Build Inventory Control

Nuclear Development Corporation of America (NDA) is the new name for the former Nuclear Development Associates, Inc., of White Plains, N. Y. The corporation will have new headquarters at 5 New St, White Plains. It also is developing a 1200-acre tract near Pawling, N. Y., to serve as a Nuclear Experimental Station.

NDA is building an automatic inventory control system to watch over 35,000 inventory items in the stock rooms of the Otis Elevator Co. This computing machine will cost over $200,000 to design, build, test, and install.

Otis officials estimate that the electronic "brain" will save the company $120,000 annually in controlling the $10 million inventory it carries to build and service elevators in its world-wide operations.

GE Starts Construction at Irmo and North Bergen

Construction of two new facilities have been announced recently by General Electric Co.

At Irmo, S. C., near Columbia, a new plant will manufacture electrolytic capacitors for color television sets, starting production next year.

This plant, costing about $6.4 million, will be built on a 135 acre site and will consist of two buildings having a total of 105,000 sq ft of floor area.

In North Bergen, N. J., will be constructed a multi-million dollar apparatus service shop, providing maintenance facilities for New York state and New Jersey. The one-story structure will have more than 132,000 sq ft of floor area, to be completed in April of 1956.

Glastic Corp Expands

Glastic Corp, maker of glass-reinforced plastic insulation in sheet and rod forms, is moving to a new and larger plant at 4321 Glen Ridge Rd, Cleveland 21, Ohio. The move will enable Glastic to double its output.

Anaconda Adds Aluminum Cable Facility

Anaconda Wire & Cable Co recently started production of aluminum wire and cable in a new building at its Sycamore, Ill., mill. When operating at capacity, the self-contained factory will quadruple output of bare, rubber-insulated and synthetic-insulated aluminum wire and cable at this plant.

The new facility is equipped with automatic machinery for drawing, stranding and insulating aluminum wire. As in all Anaconda's plants, aluminum and copper production are carried on in separate locations to eliminate possible contamination of one metal by the other.

This plant is the most recent example of the company's increasing interest in aluminum. Other aluminum facilities are the Anaconda Aluminum Co's reduction mill at Columbia Falls, Mont., (EW, Aug. 15 '55, p 56) and the Wire and Cable Co's rod-rolling mill at Great Falls, Mont. (EW, Oct. 25 '54, p 59). These facilities compliment aluminum manufacture at Hastings-on-Hudson, N. Y., Marion, Ind., and Orange, Calif.

MANUFACTURING BRIEFS

Keuffel & Esser Co, 88-year old manufacturer of drafting, reproduction and surveying equipment, is completing decentralization of manufacturing and is setting up a centrally located distribution center at Teterboro, N. J. Production will continue in Hoboken as since 1880; also specific items will be manufactured in five other plants. The company's general office, located in Hoboken since 1907, will also continue to be maintained there.

Corrosion Research Council of the Engineering Foundation announces that it will make a determined effort to learn more about metallic corrosion which annually costs industry $5 billion or more in losses due to failure and fatigue of metals in critical spots.

Philco Corp's board chairman, William Balderston, recently told a group of distributor executives that industrial research is a major force in the expanding United States economy. He went on to say that research in the past quarter century has "paid off" in new products, lowered production costs, and other benefits worth $400 billion on an investment of about $30 million for research in the same period.

Hotpoint Co has a new home laundry factory of 500,000 sq ft floor area, manufacturing automatic washing machines and clothes dryers. New building was built over an existing building at 5660 West Taylor St., Chicago, in 14 months and with uninterrupted production schedule.

Wheeling Corrugating Co will have a half-million dollar warehouse and office building in Minneapolis in about eight months. Contracts have been awarded recently for a 220 by 240 ft building. The company is a subsidiary of Wheeling Steel Corp, manufacturer of expanded metal and galvanized ware.

Radio Corp of America has completed a 150-mile, multi-hop microwave radio relay system which links the Utah Power and Light Co at Salt Lake City with four of its hydroelectric plants. Installation uses standard RCA CW-20A equipment to provide voice, telemetering, and supervisory control circuits. A second system with the same type of equipment will extend the new microwave network approximately 40 miles.

Electric Controller & Mfg, Cleveland, has doubled the facilities for winding and rewinding electric lifting magnets at its new plant with the installation of a second winding machine.

Westinghouse Electric Corp has installed an analog computer at its transformer division, Sharon, Pa., to study the effects of lightning surges on electrical apparatus. Another computer, an International Business Machine's Model 705, will be installed next year.

G. A. PRICE

Top echelon expanded with Price, Chairman; Cresap, Executive VP; other shifts made as . . .

M. W. CRESAP, JR

Westinghouse Ups 6 Officials

Gwilym A. Price has been elected chairman of the board and president of Westinghouse Electric Corp. Occupying the chairmanship, vacant since 1951, Price continues as chief executive officer and president, posts he has held since 1946.

Mark W. Cresap, Jr, has been elected executive vice president, deputy chief executive officer, and a member of the board and executive committee. Since joining Westinghouse in 1951, Cresap has served as vice president and assistant to the president. Latham E. Osborne, executive vice president since 1951, has been elected vice chairman of the board.

Responsibility for operations of the product groups has been assumed by John K. Hodnette, elected a director and vice president-general manager. A. C. Monteith, vice president of engineering and research since 1948, fills Hodnette's post as head of Apparatus Products Division. Succeeding Monteith is Dr John A. Hutcheson, director of Westinghouse Research Laboratories since 1949 and a vice president since 1950.

L. E. OSBORNE

A. C. MONTEITH

J. K. HODNETTE

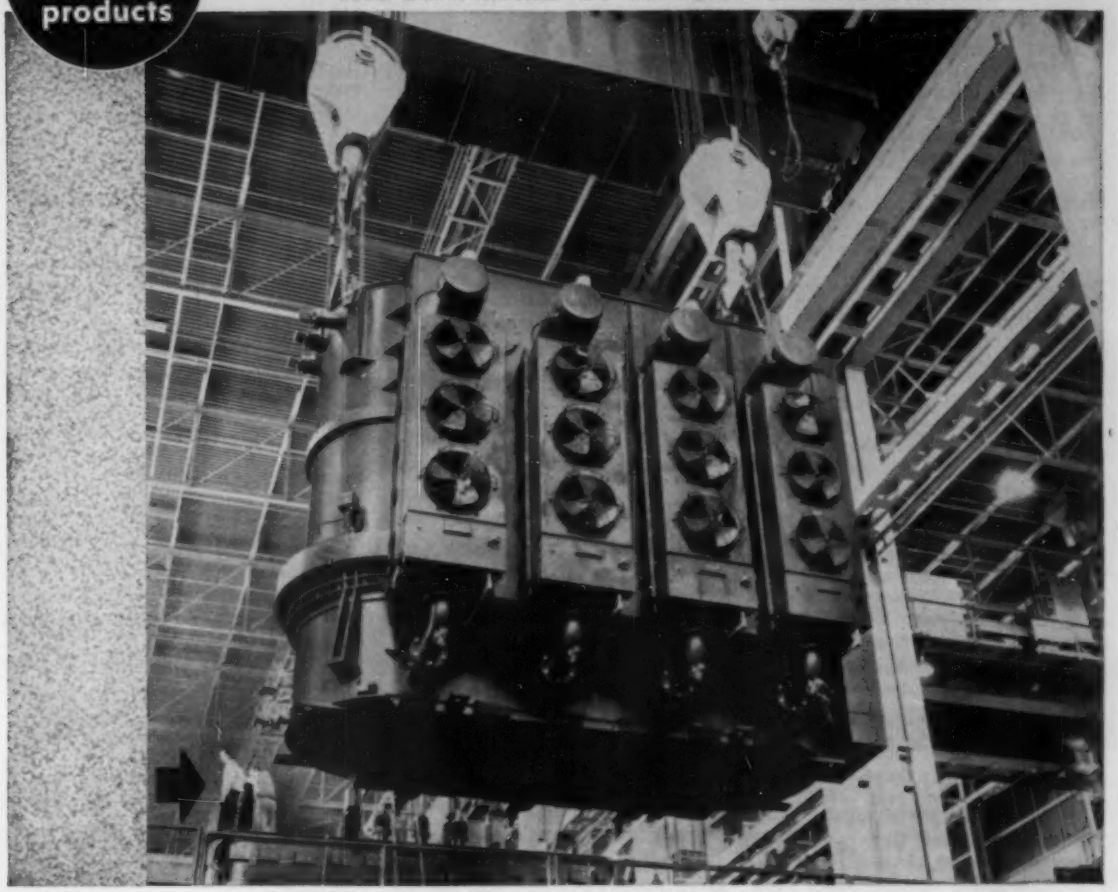
DR J. A. HUTCHESON

(*Personal Briefs on page* 164)

ACCO products

ACCO Registered* Wire Rope Slings

THE STANDARD OF EFFICIENCY AND SAFETY



UTILITIES AND MANUFACTURERS AGREE—

"You Can't Afford Not to Use Them!"

• You can't afford to take chances with equipment like this 140-ton transformer. That's why prominent manufacturers of central station equipment, as well as leading utilities, specify ACCO *Registered* Slings.

For ACCO *Registered* Slings incorporate extra safeguards which make them the safest slings available. Each individual component, made from the highest quality material suited to its use, was tested before assembly. These components were assembled according to carefully engineered and tested designs, to meet uncompromising standards. Construction features exclusive with ACCO *Registered* Slings, such as DUALOC endings, were used to provide extra safety. Then the completed sling was proof tested before being awarded the ACCO Registry Certificate.

The ACCO *Registered* program, with its rigorous quality control, proof testing, and exclusive construction features, provides the ultimate in lifting security and longer sling life. The extra security alone dictates the choice of ACCO *Registered* Slings for utility operations. As one station superintendent said: "In this plant we can't afford to use any other sling."

*Trade Mark Registered

Descriptive literature gladly sent on request

ACCO

TRADE MARK

Wire Rope Sling Department

AMERICAN CHAIN & CABLE

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn. • In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

Better Value

MEETINGS CALENDAR

An extended list of coming meetings appears in the last issue of each month

SEPTEMBER

SECOND WESTERN AREA DEVELOPMENT CONFERENCE—Sponsored jointly by Stanford Research Institute, the American Industrial Development Council and the Pacific Northwest Trade Association, Multnomah Hotel, Portland, Ore., Sept. 8-9.

ROCKY MOUNTAIN ELECTRICAL LEAGUE—Annual Fall Convention, Grand Teton Lodge, Jackson Hole, Wyo., Sept. 11-14.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—2nd Electrical Conference of the Petroleum Industry, Shamrock Hotel, Houston, Tex., Sept. 12-14; Industrial Electronics Conference, Rockham Memorial Auditorium, Detroit, Sept. 28-29.

ILLUMINATING ENGINEERING SOCIETY—National Technical Conference, Cleveland, Ohio, Sept. 12-16.

INSTRUMENT SOCIETY OF AMERICA—10th Annual Conference and Exhibit, Shrine Exposition Hall and Shrine Auditorium, Los Angeles, Sept. 12-16.

EDISON ELECTRIC INSTITUTE—Residential Promotion Committee, Headquarters, New York, Sept. 12-13; Accounting Division Organization Meeting with American Gas Association, Netherlands Plaza Hotel, Cincinnati, Sept. 12-14; Commercial Division Executive Committee, Headquarters, New York, Sept. 14; Farm Group Committee organization meeting for 1955-56, Hotel Roosevelt, New York, Sept. 15-16; Street Lighting Committee, Cleveland, Ohio, Sept. 18-19; Industrial Relations Round Table Conference, Drake Hotel, Chicago, Sept. 19-21; Industrial Power & Heating Group, EEI Headquarters, New York, Sept. 22-23; Northeastern Area Dealer Coordination Workshop, New Ocean House, Swampscott, Mass., Sept. 22-23; Purchasing and Stores Committee, EEI Headquarters, New York, Sept. 26; Transmission and Distribution Committee, Jung Hotel, New Orleans, Sept. 29-30.

ASSOCIATION FOR COMPUTING MACHINERY—Annual Meeting, University of Pennsylvania, Sept. 14-16.

PUBLIC UTILITIES ASSOCIATION OF THE VIRGINIAS—37th Annual Meeting, Greenbrier Hotel, White Sulphur Springs, West Va., Sept. 15-17.

***THE MARYLAND UTILITIES ASSOCIATION**—31st Fall Conference, The Cavalier Hotel, Virginia Beach, Va., Sept. 16-17.

SYMPOSIUM OF ELECTRONIC AUTOMATION—University of Pennsylvania, Irvine Auditorium, Philadelphia, Sept. 19-20.

SOCIETY OF INDUSTRIAL PACKAGING AND MATERIALS ENGINEERS—10th Anniversary Meeting, Kingsbridge Armory, New York, Sept. 19-22.

PENNSYLVANIA ELECTRIC ASSOCIATION—Annual Meeting, Benjamin Franklin Hotel, Philadelphia, Sept. 20-21; Transmission & Distribution Committee, Fort Bedford Inn, Bedford, Pa., Sept. 28-30.

NATIONAL INDUSTRIAL CONFERENCE BOARD—Marketing Meeting, Waldorf-Astoria Hotel, New York, Sept. 21-23.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Accounting Conference, President Hotel, Kansas City, Mo., Sept. 22-23.

NORTHWEST PUBLIC POWER ASSOCIATION—Accounting Section, Winthrop Hotel, Tacoma, Wash., Sept. 22-23.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, and Subcommittees, Charlotte Hotel, Charlotte, N. C., Sept. 22-23.

NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS—Pacific Zone, Annual Convention, Empress Hotel, Victoria, B. C., Sept. 25-28.

SYMPOSIUM ON ELECTRONIC AUTOMATION—University of Pennsylvania, Irvine Auditorium, Philadelphia, Pennsylvania, Sept. 26-27.

ASSOCIATION OF IRON AND STEEL ENGINEERS—Annual Convention, Hotel Sherman, Chicago, Sept. 26-29.

ATOMIC INDUSTRIAL FORUM, INC—1st Trade Fair, Sheraton-Park Hotel, Washington, D. C., Sept. 26-30.

STANDARD ENGINEERS SOCIETY—4th Annual Meeting, Hotel Statler, Hartford, Conn., Sept. 29-Oct. 1.

OCTOBER

NATIONAL ELECTRONICS CONFERENCE, INC—Hotel Sherman, Chicago, Oct. 3-5.

EDISON ELECTRIC INSTITUTE—Meter and Service Committee, Hotel Syracuse, Syracuse, N. Y., Oct. 3-5; Prime Movers Committee, Hotel Cleveland, Cleveland, Ohio, Oct. 3-5; Electrical Equipment Committee, Shoreham Hotel, Washington, D. C., Oct. 17-18.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Fall General Meeting, Morrison Hotel, Chicago, Oct. 3-7.

ELECTRIC COMPANIES PUBLIC INFORMATION PROGRAM—Workshop Conference, Chase-Park Plaza Hotels, St. Louis, Mo., Oct. 5-7.

IOWA UTILITIES ASSOCIATION—8th Annual Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, Oct. 10-11.

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS—Fall Meeting, Peabody Hotel, Memphis, Tenn., Oct. 14-15.

***AMERICAN WELDING SOCIETY**—National Fall Meeting, Bellevue-Stratford Hotel, Philadelphia, Oct. 17-21.

SOUTHEASTERN ELECTRIC EXCHANGE—Accounting Conference, Hotel San Carlos, Pensacola, Fla., Oct. 20-21; Sales Conference, Biltmore Hotel, Atlanta, Ga., Oct. 27-28.

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*Additions this week.

New System Maps

(*Continued from page* 87)

"units" were perpetuated at an average time per "unit" of 2 hours and 17 minutes. Under the new system, 9,650 were perpetuated in a year at an average time of 2 hours and 5 minutes. This saved about $9,600. The savings can be considered even greater because a new map probably replaced about seven or eight of the old. Also to be considered is the recent building boom which added a much greater work load to perpetuation. If these facts are taken into consideration an annual saving of about $15,000 can be shown.

Now that the new operating map system has been completed, exhaustive studies are being made on a system of recording that would relieve a large percentage of draftsmen from the recording work and divert their talents into more productive work. The system would provide for a small group of experienced draftsmen to be supplemented by a semi-skilled group for finalling out onto the original. This method is not new to mapping or statistical drafting, but it has just about reached the stage where it is economical for the Con Ed System.

Sylvania Mercury Vapor street lighting at Huntington, California

SYLVANIA MERCURY VAPOR—

modern solution to street lighting problems

MOST EXPERTS AGREE . . . your best buy in street lighting is mercury vapor, for both performance and economy. And for all-around dependability, Sylvania Mercury Vapor lamps are the choice of experts!

Only Mercury Vapor street lighting with Sylvania lamps offers *all* of these advantages . . . combining immediate as well as long-range benefits . . .

- **High efficiency**
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- **Excellent night visibility**
- **Minimum cost per unit of useful light**

Because of these unsurpassed advantages, you will find that the majority of new street lighting installations are mercury vapor . . . and that leading lighting engineers choose ruggedized Sylvania Mercury Vapor Lamps for reliable performance. If you are contemplating street lighting or parking lot installations, Sylvania's informative new booklet "Today's Most Effective Street Lighting Source" is yours upon request.

For technical information and application data on Sylvania Mercury Vapor Lamps, write to:

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- **ELECTRONICS**
- **TELEVISION**
- **ATOMIC ENERGY**

SYLVANIA®

. . . fastest growing name in sight

Milliken Station Features New Power Plant Design Ideas

(*Continued from page* 81)

selected to provide reliability of service and to facilitate handling. In spite of economic advantages favoring a single larger unit, two 90-Mva, 13.2 to 115-kv, 3-phase, FOA units were purchased. One sustained plant outage because of transformer damage could cost more than the difference in first costs between the single unit and two smaller units.

A special consideration which influenced this decision is that a spare 3-phase transformer of ratio and voltage class to operate at any one of the company's generating stations is maintained for use in case of damage to a generator transformer on the system. A railroad well-car, owned by the company, can transfer this spare transformer to any location.

Local distribution at 34.5 kv and station auxiliary starting and emergency power at 4,160 v are obtained through a step-down 3-winding bank from the 115-kv bus.

Fire walls will separate the main power transformers from each other. An automatic, heat-actuated, fog-type fire extinguishing system will be installed over the main power transformers and remote manually controlled sprays around the head end of the turbine below the main operating floor. A separate engine-driven fire pump capable of 1,000 gpm and a booster pump using house service water will supply water to the fire main piping system. Metal lagging over pipe insulation will be provided at the head end of the turbine on all piping that could be exposed to a serious oil leak. Mineral insulated cable will be used in the turbine area where there is a hazard of oil fires. Where possible enclosed steel cable raceways will be used with Transite fire barriers beneath. For emergency use a fire proof escape corridor connects a control room to a building exit.

A study of ventilation and heating requirements showed that ventilation of dead air spaces and areas of high heat load could be served by a large central system with a minimum of local fan and heating elements.

The two rooms containing the 4,160-v, 480-v, and 120/208-v switchgear will be served by a common forced air ventilating system. Battery and relay room will take air from the same system but passes it through a 10-ton air conditioning unit. The control room will have a separate ventilating system incorporating a 15-ton air conditioner. All of the above areas will be completely inside the plant and will have no direct outside air inlets except through the fan system.

Lower plant levels will be ventilated by forced air through a 58-in. by 60-in. duct which will split up to serve various portions of the basement. All the preceding systems will be equipped with air washers and heating coils and induce outside air through the westwall of the plant some 70 ft above grade.

Hot spots around the boiler and air heaters will be served by individual axial flow fans which force low pressure outside air to these locations through short runs of duct work on the individual fans. No air washers or heating coils will be provided in these systems.

Roof ventilators employing centrifugal fans are installed on the boiler and turbine room roofs to provide an upward air flow in the station and remove the hot air under the roof.

PERSONAL BRIEFS

Herman J. Gallagher, general farm service supervisor for Consumers Power Co, has received Michigan State University's centennial award and citation for achievement as a "pioneer and leader in the field of farm electrification."

Miss Frances Maness has joined Virginia Electric & Power Co as home service director in charge of a staff of 29 home economists in Virginia and North Carolina.

Development & Resources Co has been recently formed to provide organizational, technical, and financial direction in development of natural resources outside the U. S. **David E. Lilienthal,** former chairman of Tennessee Valley Authority and first chairman of Atomic Energy Commission, has been named chief executive officer and chairman of the new firm. **Gordon R. Clapp,** Lilienthal's successor as TVA chairman, has resigned as deputy administrator of New York City to become president of Development & Resources.

J. L. Cross, manager of power equipment sales for Westinghouse Electric Corp's Transformer Division, has been loaned to the government for six months. He assumes duties as director, Electrical Equipment Division, Business and Defense Services Administration, U. S. Department of Commerce.

Radio Corp of America has elected **Ralston H. Coffin** vice president of advertising and sales promotion. For the last 18 months Coffin has been director of advertising and sales promotion.

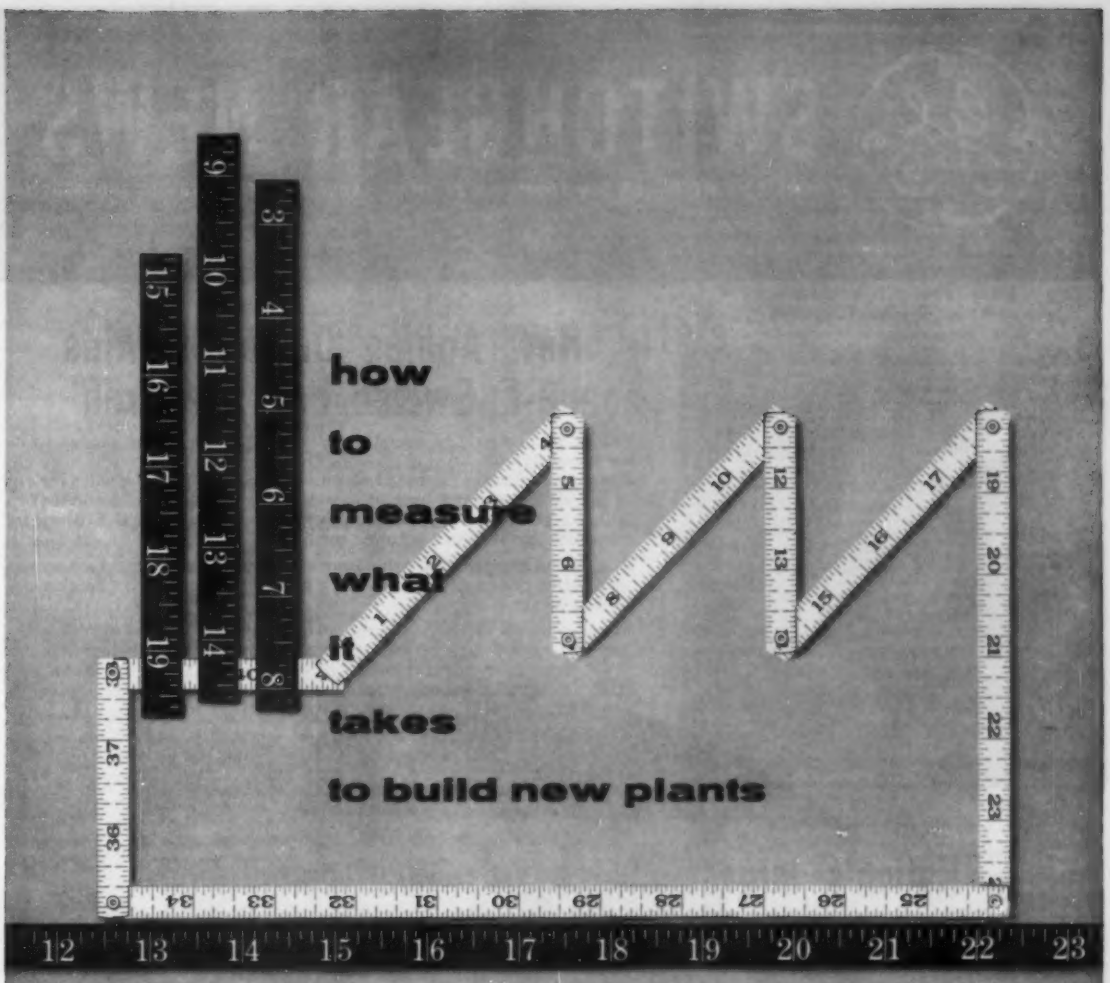
F. William Jahns, Jr, has been promoted from assistant plant manager at the Newark, Del., plant to supervisor of a newly created technical sales service of Continental-Diamond Fibre Division of Budd Co, Inc . . .

Leeds & Northrup Co has elected **Alexander H. Reynolds, Jr,** treasurer. He continues as controller of the company.

OBITUARY

Mathias S. Henter, 63, electrical engineer with Allis-Chalmers Manufacturing Co, died last month at Milwaukee, Wisc. He made the original layout for the 300,000-kw generator presently under construction for Detroit Edison Co.

George S. Holmes, 71, director of information for Defense Electric Power Administration during the Korean crisis, died in Washington, D. C. A former managing editor of the Rocky Mountain News in Denver, Holmes more recently was Washington correspondent for several western newspapers.



Most ingredients that go into a new plant can be measured by feet or yards, pounds or tons. But there are other things—far more important—that physical yardsticks can't size up.

Experience, for example. Ebasco experience spans half a century, and includes the engineering and construction of more than two billion dollars of plants in the United States and abroad.

Skill and integrity are evidenced in each phase of an Ebasco project. Ebasco's highly qualified technical skill is utilized in every part of the work—from site selection and preliminary planning, through finished construction, to successful operation.

Together these unseen elements add up to *quality* construction, the common denominator of every plant built by Ebasco.

If you are considering a new plant, write for our booklet, "The Inside Story of Outside Help". Address: Ebasco Services Incorporated, Two Rector Street, New York 6, New York.

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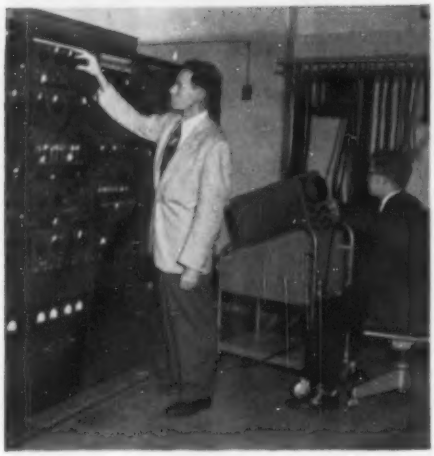
SWITCHGEAR NEWS

NEWS OF SWITCHGEAR DEVELOPMENTS OF IMPORTANCE TO THE ELECTRICAL INDUSTRY



New Analog Computer Aids G-E Switchgear Research

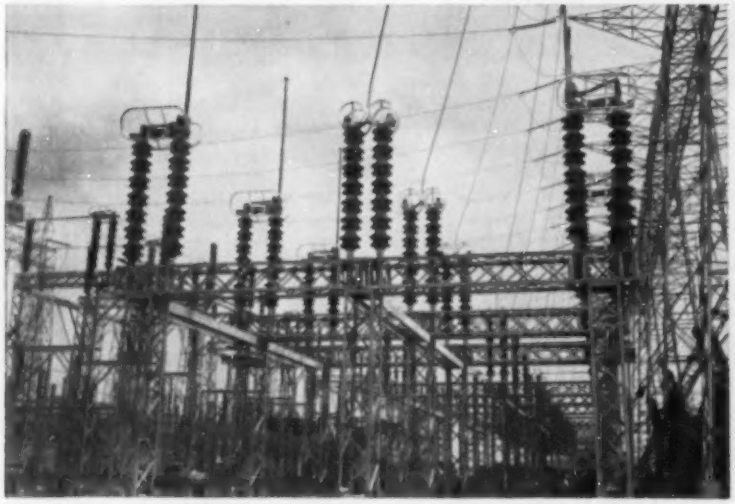
During its first year of operation the analog computer has proved to be an extremely useful tool in speeding General Electric switchgear research. Its primary function is to investigate the performance of a wide variety of mechanical systems used in G-E switchgear products. In addition to saving a great deal of time, the new computer has given G-E designers vital data unobtainable by other methods.

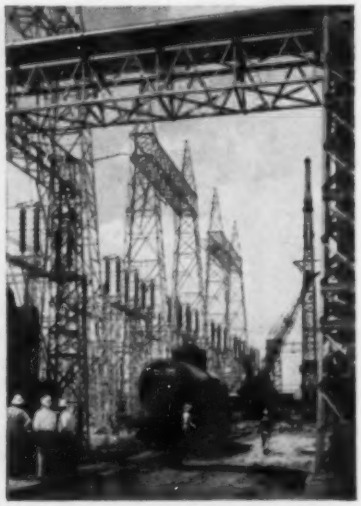
Among the important contributions made by the new computer was the verification of the design of the new high-speed distribution breaker described on the next page.

Many other problems are now under consideration which will ultimately result in improved switchgear performance. Among them is investigation of the contact bounce phenomena in the cup-type relay. Results of this study should make it possible to increase contact efficiency and life.

G.E.'s speeded-up research program has resulted in increasingly complex problems being handed to the computer. To keep up with this increasing load, new additions have been made to the original installation, until today, the computer, with a total of 12 integrators, is able to represent a six-degree-of-freedom system.

Nation's largest switchyards near completion





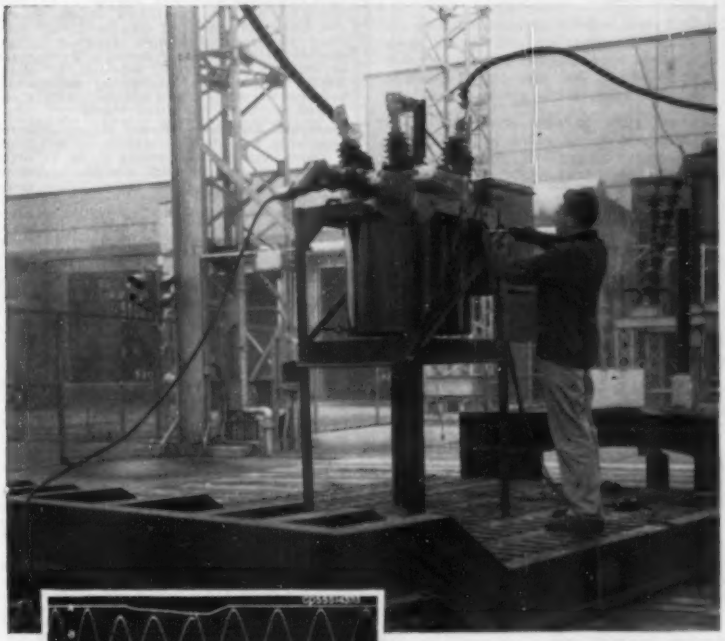
Two of the largest and highest voltage outdoor substations ever built, rated at 1,000,000 and 1,300,000 kva, each including approximately 800 tons of steel and covering approximately 13 acres, are now under construction for an important AEC project. The switching structures of the 330-kv substations were designed and furnished by the General Electric Company's High Voltage Switchgear Department at Philadelphia. They will be used for switching the large amounts of power required for a new installation.

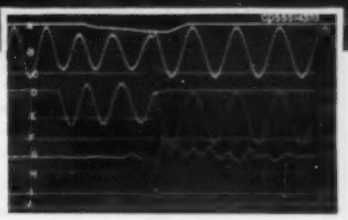
The stations utilize a total of 114 air switches rated 330 kv, along with a number of the new 25,000,000 kva interrupting capacity power circuit breakers. Aluminum buses are used throughout the stations and designed to carry a continuous current of as much as 2000 amps. More than 4000 strain insulators and 6000 bus and switch insulators were required for each station.

General Electric announces . . .

NEW 5-cycle distribution breaker

High-speed Interruption Minimizes Chance of Line Burn-down, Offers Closer Co-ordination of Fuses





New breaker has been subjected to extensive full scale power and capacitance switching tests at G-E Development Laboratory. Oscillograms consistently show better than 5-cycle interruption.

A new oil power circuit breaker for distribution system application is now in production at General Electric's High Voltage Switchgear plant in Philadelphia.

Rated to interrupt distribution loads in 5 cycles at 14.4 kv, the new breaker offers distribution engineers the opportunity of increasing transformer sizes to meet load growth without need for changing to a heavier wire system.

On systems using 1/0 wire, for example, the new breaker would permit transformer capacities to be increased 68% over burn-down values considered safe for the standard 8-cycle breakers now in use. Faster interruption will also enable better fuse protection of distribution equipment because smaller ratings of co-ordinated fuses may be applied.

To achieve smooth, positive closing, G-E engineers teamed a stored-energy torsion spring with a low-impact cam-drive mechanism. The mechanism is both mechanically and electrically trip-free and can provide instantaneous initial reclosing even if closing power supply is unavailable.

Powered by a 400-watt universal motor, the spring charged mechanism eliminates the need for heavy closing power supply sources normally required with distribution breakers.

The new, stronger cylindrical tank breaker requires 26% less station space than did the previous square tank breakers. Six bayonet type interrupters are incorporated in the single-tank construction.

The higher-speed 5-cycle breaker supersedes G.E.'s 8-cycle Type FLO breaker and is being introduced at no increase in price.

For further information, see your General Electric representative, or complete the bulletin-request coupon on this page.

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GENERAL ELECTRIC

SECTION F491-1
GENERAL ELECTRIC COMPANY
SCHENECTADY 5, NEW YORK

Please send me the following bulletins:
☐GEA-6295 New 5-cycle Distribution Breaker
☐GEA-5961 Impulse Oil Circuit Breakers (138-300-kv)

Name .....
Company .....
Street .....
City ..... Zone ... State .....

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The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

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Selling Opportunities Offered

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$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

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Free group life and hospitalization insurance, liberal sick leave plan, five day week and a liberal vacation plan are but a few of the benefits you will receive. Engineering positions are available throughout lower Michigan. If you have a recent degree in electrical or mechanical engineering, we suggest that you investigate these career opportunities.

Apply in person or write to: R. E. Beatty,

CONSUMERS POWER CO.,
212 W. Michigan Ave. Jackson, Mich.

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Opportunities for young engineering graduates with interest in the electric power field.

Our work includes systems planning engineering; plant and substation engineering; transmission and distribution engineering. We also have openings for men interested in power sales.

These positions offer excellent opportunities for advancement in the expanding electric utility business.

Write direct giving age, education, experience, personal particulars and salary desired.

The Cleveland Electric Illuminating Company
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The engineers and technicians you want to reach are gathered in convenient, compact groups—as this 12-page booklet points out.

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LOS ANGELES: 1111 Wilshire Blvd. (17)

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Distribution Engineers—Two competent graduate electrical engineers, age 30 to 40, with minimum 8 years experience design, operation and maintenance of distribution of facilities, required by rapidly growing utility, desirable location South America, Portuguese or Spanish useful—not essential to start. Reply stating age, education, experience, personal particulars and minimum salary expected. P-7541, Electrical World.

Electrical Engineers—Power Major—Several assistants and juniors—assistants minimum 5 years experience—juniors 2 to 3 years experienced in electrical design, operation and construction of steam, diesel, hydro, electric plants and substations. Permanent position with long established consulting organization for public utility operating companies located Latin America. Headquarters New York. Some travel necessary in future. Knowledge of Spanish or Portuguese useful—not essential. Salary commensurate with qualifications. Good opportunity. Reply stating age, education, experience, personal particulars, and minimum salary expected. P-7542, Electrical World.

Sales Manager—Industrial Electrical Equipment. Nationally known design and manufacturing company has opening in the Southwest for a trained electrical engineer with sales experience. Excellent administrative opportunity for qualified person. Should be 33 to 43 years of age; have an electrical engineering degree; and a minimum of seven years full-time professional experience, including 5 years in responsible sales work. Must be familiar with agency distribution channels and qualified to direct an aggressive sales program. Reply Box P-7531 giving personal data, education, experience and availability.

Product Engineer—Graduate engineer with utility experience in transmission and distribution desired, for design and quality control with company manufacturing power line connectors, splices and deadends. Will work closely with sales and production departments as well as other engineers. Salary open. Reliable Electric Company, 3145 Carroll Avenue, Chicago 12, Illinois.

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PLANTS & PROPERTIES

For Sale. Brick building app. 42x128 on corner lot, front half two story suitable for clinic, grocery store, lodge hall, apartments, garage and show room, general store, new furnace, modern structure. Bids will be received up to September 16th, 1955 with right to accept or reject all bids. Presently occupied by owners. Lorain Medina Rural Electric Cooperative, 224 N. Main St., Wellington, Ohio.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4500) will be received at Denver, Colorado, until September 20, 1955, for furnishing motor-driven, horizontal, centrifugal-type pumping units having the following capacities under a total head of 120 feet: one 20 cubic feet per second; one 30 cubic feet per second; and two 40 cubic feet per second; each, for Ontario-Nyssa Pumping Plant, Owyhee Project, Oregon-Idaho. Delivery is desired within 330 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado.
W. A. Dexheimer, Commissioner.

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4499) will be received at Denver, Colorado, until September 27, 1955, for furnishing 3-pole, single-throw, outdoor, manually-gang-operated disconnecting switches, as follows: twenty-two 115-kv, 600-ampere; three 69-kv, 600-ampere; and one 15-kv, 400-ampere; also fifteen 15-kv, 400-ampere, single-pole, single-throw, hook-operated, outdoor disconnecting switches for Palisades Switchyard, Palisades Project, Idaho. Delivery is desired within 180 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

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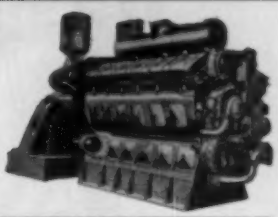

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1136	Fairbanks Morse	38D	1600	720	300	Fairbanks Morse	32E14	450	300
1100	General Motors	16-278A	1600	720	300	General Motors	8-268A	450	1200
1000	General Motors	16-567B	1440	720	250	Clark	GD-4	375	360
730	General Motors	12-567	1090	720	200	General Motors	8-268A	330	900
700	Worthington	EE-6	1000	327	175	General Motors	12-71	275	1800
675	Fairbanks Morse	38D	960	720	150	Buckeye	80	240	600
500	General Motors	8-567	720	720	148	Fairbanks Morse	32E14	220	300
500	Alco	6-12 rx13T	750	600	100	General Motors	3-268A	150	1200
350	Baldwin	VO-6	510	450	60	General Motors	6-71	90	1200
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3— 333 KVA G-E 33000-2300/4000Y/6900/11950Y
3— 333 Kva Wagner 6900/11950Y-7200/12470Y
3— 250 Kva G-E 2415/2300-600
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W.H. DC exs., type SK, 10 K.W., 125 volts, 128 amps., 3600 R.P.M., frame 43, stg. No. 26136.

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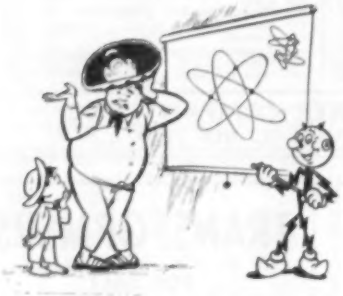
P. O. Box 516 Sausalito, California

Construction



Atomic Energy

Maintenance

Load Building

Readers Reacted Favorably . . .

. . . when Arizona PS adopted the novel technique of using comic strip characters to tell the story of its 1954 annual report

When Arizona Public Service Co introduced a pair of comic strip characters into its 1954 annual shareholders report, it was not quite sure just what the results would be. The annual report, by reason of its subject matter, normally is a staid and conservative document. Trying to tell the story of the report through comic strip characters could have backfired for the company, but later results showed it didn't.

How to Get Readership?

At their initial session on the report Arizona PS planners were confronted with a problem common to all utilities: How to make an interesting document that would be read out of material which generally has little interest for the average stockholder.

"If we could turn out a report that had one-tenth the readership of any of our comic strips, we'd have it made," said one of the members of the group. This chance remark started the wheels turning.

With Gus Arriola, the creator of "Gordo," living in Phoenix, it was natural that the company should decide that the Mexican taxi driver and his impish nephew Pepito were the perfect characters to use in conjunction with Reddy Kilowatt in telling the story of the annual report.

Reaction Was Immediate

"Gordo", copyrighted by United Features' Syndicate, Inc, appears in 130 newspapers throughout the country.

And what was the result?

Reaction to the report was immediate and favorable. The fact that there was reaction was in itself an indicator that the report had rung a bell. Normally, according to the company, response to the annual report does not rate as remarkable.

Letters from all over the country came in commenting on the report. Only one letter found the comic strip characters objectionable.

Here are some comments from letters received by the Arizona Public Service:

". . . thank you for sending me your 1954 annual report . . . it is one of the most attractive ones I have ever seen . . ."

"Annual reports are usually pretty dry reading for the average stockholder, but your 1954 report, taking us on a trip through Arizona with Gordo and Pepito is not only unusual, but very interesting and very cleverly done . . ."

"In my opinion, this is the most attractive annual report that I have had the privilege of reading."

"I have read with pleasure and profit the 1954 annual report of Arizona Public Service Co and want to compliment you on this fine job."

The lone dissenter wanted to know, "are such silly, childish characters necessary to attract our attention to an otherwise beautifully compiled annual report?"

In addition to these comments from persons on the company's regular mailing lists, Arizona PS received numerous requests for extra copies of the report, making it necessary to reprint an extra thousand copies.

PR&A BRIEFS

• Electric Companies Advertising Program kicked off its Fall "You Are There" television schedule Aug. 28 with program dealing with events of Pearl Harbor Day.

• Boston Edison Co has revised its booklet for company employees on its "Major Emergency Plan of Operation." Latest revisions incorporate experience arising from 1954 hurricanes. Booklet includes hints on dealing with public and how to answer customer telephone calls so as to create goodwill. For copy, write to J. V. Macdonald, Manager, Advertising and Promotion Department, Boston Edison Co, 39 Boylston St, Boston 12, Mass.

New . . . but time-proved

Basic design unchanged

in new industry standard bushing

Fourteen years' experience with the present type S design backed by 48 years of experience with basic condenser bushing design stand behind the bushing shown here. No change in the basic Westinghouse design was required when dimensions were modified to meet the new ASA Industry Standard. The condenser construction originated by Westinghouse in 1907 is now used throughout the industry.

758,535 bushing years of service since 1941 have proved the soundness of the Westinghouse design features listed below:

1. Solder sealing—makes integral assembly of stud, condenser, flange and porcelain; eliminates gaskets.

2. Condenser foil layers completely surrounded by solid insulation—prevents corona, eliminates radio and television interference.

3. Low power factor insulation—no change in thickness with new dimensions.

4. Westinghouse high-strength, wet-process porcelain—manufactured to rigid standards in our own porcelain works.

5. Ungrounded power factor test tap—a new feature now available.

6. Specially developed plastic compound for filling the bushing—stays plastic and adhesive to −50°C; an improvement over oil as a filler.

7. Flexible cap—allows expansion and contraction without injury to solder seal.

For complete information, call your Westinghouse sales engineer, or write Westinghouse Electric Corp., P. O. Box 868, 3 Gateway Center, Pittsburgh 30, Pa.
J-60876

YOU CAN BE SURE... IF IT'S
Westinghouse

READERS FORUM

Operator Speaks Out for the 'Peepul'

To the Editor:

In reply to your request for assistance on terminology, I wish to inform you that I am a substation switchboard operator and feel that classification is about as close as you can come to a transition of the "peepul" and the industry.

"Boiler" definitely. Water is boiled, not steam; so steam boiler is out. True, steam is generated but only as a result of the first even though steam is the desired product. Many people would define a steam generator as being an electrical generator driven by a steam engine. Due to the fact most everyone has heard of an electrical generator on an automobile, mention of the word "generator" right away brings to their minds some kind of a machine that produces electricity.

"Heat Pump" is fine for the industry. Air conditioning, to the great mass of people covers everything from a fan to circulate the air to the most elaborate refrigeration unit and means "cooling". Electric air conditioning would mean a fan, evaporative cooler, or refrigeration unit when thought of as cooling and as using great amounts of electricity when thought of as heating. "All-Season" air conditioning would cover the whole year. That, of course, could be obtained in other ways than the heat pump. "Heat pump" signifies heating to many people. "All-season heat pump" or "all-season temperature pump" might cover it.

"Turbogenerator" is correct by general usage. "Turbo," to me at least, denotes some type of machinery driven by a turbine, such as "turbo-prop" in the latest combination of propellors and jets on airplanes. Turbine of course includes water, gas, steam, etc. The term "turbogenerator" would denote an electrical generator driven by a steam turbine to most people.

"Adequate Wiring" is about it although to many people wouldn't be too clear. To most people I know, their wiring is either "light" or "heavy." "Our wiring isn't heavy enough." "Our wiring is too light." "We have to have heavier wiring put in." For advertising, "If your home is a few years old, chances are the wiring isn't 'heavy' enough for modern appliances."

"Megawatts" must be almost universally accepted in the industry; is it not?

"Atomic power plant" will almost always be used from kids on up regardless of the more technical names used by engineers. Kids hear of atom bombs and have atomic toys of all kinds and will always associate "atomic" with anything of that nature.

I see nothing wrong with present meters and no great saving, in fact a lot of confusion and expense in changing over. Reading every two months is more logical.

Pet Peeves: When is the industry going "to get on the ball" and educate the public via newspapers and magazines about electricity, the one single thing that most dominates their lives and about which they know the least?

There should be a series of lessons that could even be included with or on their bills. Explain roughly how it is generated, transmitted, and distributed. Dangers about the home; that is, what is a danger and what is not. Many people are afraid to change a fuse. Some people save up ironing until they have a certain amount because it is expensive to "heat up the iron." Give the cost of heating up an iron. Explain what fraction of a cent may be saved in an evening by turning a light on and off several times rather than letting it burn. They would feel silly at their frugality when they realize they have saved nothing.

Cost of electricity from conventional and atomic power plant. Our own local editor had an editorial one evening about how cheap it was going to be. Why, they will have units on a big truck that can drive up and run a whole city. It will be so cheap it may not have to be metered. Phooey! Many, many people believe what they read. And why not? They know no better and the local editor is a man of education of course. The industry better counteract many of these notions.

Gerald J. Haberman
Operator 1st "B"
Magunden Substation
Southern California Edison Co
Bakersfield, Calif.

Who Opposes 'Full Life Wiring'?

To the Editor:

I would like to submit "Full Life Wiring" as a substitute for "Adequate Wiring."

Such a name suggests an intense and broad personalized appeal that would be susceptible to extensive advertising and selling promotion.

Who doesn't desire wiring that will have itself a "Full Life?" Who doesn't desire wiring that will promote a "Full Life" for himself? Who would want the alternative of Dull Life Wiring?

W. Jack Mosley
512 Maegly-Tichner Building
610 S. W. Broadway
Portland 10, Ore.

Not Ridiculous, Just Incorrect

To the Editor:

Mr Frazer and I were pleased to note publication of our story on Power Plant Auxiliaries in the Aug. 8 issue. There is an error to which I believe attention should be called in a subsequent issue. Near the bottom of the first column on page 77, under "Constant-Speed Pump Drive . . .", the text reads "economic advantage over the variable speed drives above approximately 5% capacity tactor." The percentage should be 85 instead of 5. You will appreciate, I am sure, that this error makes the whole statement almost ridiculous.

Walter P. Gavit
Consulting Engineer
United Engineers & Constructors Inc
1401 Arch Street.
Philadelphia 5, Pa.

Here's Proof of Performance...

Mr. Thompson with one of their "new-looking" 20-year poles.

Pressure-Creosoted poles installed in 1916 still in service!

• The length of service received from any type of equipment is usually the truest test of its value and real cost. This is certainly the case with pressure-creosoted utility poles. Take the record of the Iowa-Illinois Gas & Electric Co., of Davenport, Iowa.

This utility, which serves 100,000 residential and commercial customers in both urban and rural areas, has been using pressure-creosoted poles for a long time. "Creosote-treated poles last even longer than we had expected when we originally purchased them. We've been using them since 1916 and still do not know when a creosoted pole can be called old," says Mr. William Thompson, construction supervisor. "Many of our oldest poles have been removed from their original locations. In at least one case that I can recall, poles installed in 1923 were pulled out of a 25-mile stretch in 1944, found to be in excellent shape and reinstalled in rural areas in 1945."

Mr. E. F. Miller, manager of Iowa-Illinois Electric Transmission and Distribution Division, adds, "In 1945 and 1946, we pulled out about 300 creosoted poles that were over 30 years old. Only 3 poles had to be junked . . . the rest were put back into service in various rural lines."

A good record? Certainly, but not unusual when you use utility poles pressure-treated with a good grade of creosote—like USS Creosote. For more information on this quality wood preservative, contact our nearest sales office or write to United States Steel Corporation, 525 William Penn Place, Pittsburgh, Pa.

You can obtain clean pressure-creosoted poles upon specification without sacrificing pole service life.

USS CREOSOTE

S-1004

SALES OFFICES IN PITTSBURGH, NEW YORK, CHICAGO, CLEVELAND, SAN FRANCISCO AND FAIRFIELD, ALA.

UNITED STATES STEEL

WASHINGTON COMMENT

Atomic Power Licenses Hinge on Safety

Pointers for applicants: Make bids for licenses as early as possible. Present all available facts and plans. Stress all aspects of safety program to be used

A key Atomic Energy Commission official stated recently, "There is no attempt to limit entrance into the atomic energy field." He was Harold Price, chief of AEC's licensing activities and the man who directed the writing of AEC's basic industrial participation regulations.

Price's comment is significant in that he is the top man at AEC responsible for administering the regulatory features of the new atomic law. His civilian application division not only issues licenses. It also brings AEC regulations up to date, and investigates the technical and financial competence of every license applicant.

At this stage in the civilian application division's career —it's only a few months old—Price and his aides must deal with license applications in an informal manner. This is chiefly because atomic energy licensing, whether it be for power production, use of radioisotopes, or production of equipment, is so new that nothing has yet become standardized. AEC looks forward to the day when some aspects of atomic production can be standardized. That should make its regulatory job easier. But it will not ease up in its efforts to get industry to develop the best products and procedures.

Must Insure Safety

AEC is charged under the new law with encouraging industrial development. That was the whole point of rewriting the McMahon Act. The agency has set up machinery to implement this directive. The civilian application division has authority to issue licenses to applicants who can qualify under the new regulations.

But it is also charged with protecting the public health and safety and the national security. Price's shop is chiefly responsible for administering this aspect of the law, and his staff has taken its mandate seriously.

This is the reason that it has taken so long for the few license applications submitted thus far to get through the AEC mill. The civilian application division insists that each applicant supply complete engineering data to prove that he has anticipated every conceivable accident which could occur at his proposed installation and provided fool-proof methods of offsetting or correcting it.

Licenses take Time

One of Price's top aides estimates that it would be difficult indeed for a license application to be fully processed in less than six months. More probably, the average would be a year. This assumes that the applicant be experienced in some field such as generation of power or manufacture of heavy equipment, that he be fully staffed with technical and engineering personnel, and that he have the financial stability to carry out his proposal.

Price and his staff have this advice for the businessman who would enter the atomic field: Get your application in as soon as you've decided you want a license. Present all the facts as soon as possible. Stress safety because that is the aspect which will get the roughest going over at AEC.

TECHNICAL NOTES

Tracer methods can locate and measure radioactive constituents in much smaller concentration than is usually possible with any other method.

Corona discharge will contribute considerable noise interfering with carrier reception. It also alters the impedance of the power line, and the carrier signal is thereby absorbed at a varying rate.

Neutrons, slowed by hydrogen, deuterium, carbon, or beryllium in a thermal reactor, react more readily with U-235. Weight of U-235 can be cut 90 to 99%.

Stroboscopic photo of collector rings on a generator with accurately calibrated scale for comparison enabled one utility to measure ring wear without a shutdown.

Electric panel heating for motels runs about 25 to 30¢ per room per night in cold weather.

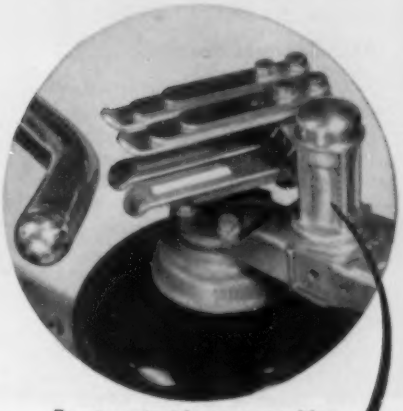
Lightning was responsible for 36.5% of the failures of dry-type transformers (1 to 1,000 kva, 220 to 13,800 v); line surges 11.5%; workmanship and overload, each 9.0%; loose connections, 7.0%; rain or snow, carelessness, foreign material, and backed-up water, each 4.5%.

Purified metals (one part impurity in 10 billion) are obtained by zone melting of bar ingots with the melted portion picking up the impurities as they progress along the bar. Impurities concentrated in the last volume to "freeze" are cut off and discarded.

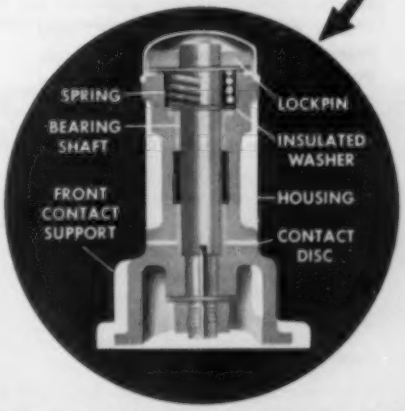
Sequence of photos of infrequently inspected turbine blades reveal progress of erosion between inspections, particularly if a new inspector takes over.

Triplex cable secondaries permit 240-ft spans for residential secondary distribution. Intervening service drops are tapped mid span.

Rugged construction of high pressure rear contact.



Front contact in open position.



NEW 3E SIDE BREAK SWITCH

THE BF-20

A completely new switch, with many advanced features that make it the best buy in low cost, outdoor switchgear . . . and its long life is assured by sound design, a minimum of parts, and extra heavy construction. Typical of the quality products that have established Three-E's reputation.

When you need a side break switch,

CHECK FOR THESE MODERN FEATURES

1. **Simple, rugged design.**
2. **High pressure silver contacts, braidless for longer life.**
3. **Toggle motion, positive ice breaking and wiping action.**
4. **The switch can be assembled for right or left hand operation, with the same components.**

Available through 161 KV, 600 Amp and 1200 Amp.

The current travels through the front contact bearing unit, which rotates to give the toggle action, and is transferred to the support at the silver contact disc. An insulated low stressed, stainless steel coil spring keeps the two parts under high pressure contact at all times.

Write for new bulletin 335.

3E — THREE E

ELECTRICAL ENGINEERS EQUIPMENT CO., MELROSE PARK, ILLINOIS

SEC Rejects Petition . . .

. . . filed by the Georgia PSC to separate the Georgia P&L from parent, Florida Power Corp, because of their interconnection

The Securities and Exchange Commission has rejected a petition by the Georgia Public Service Commission to separate the Georgia Power & Light Co from its parent company, the Florida Power Corp.

Chairman of the Georgia PSC, Matt L. McWhorter has just released a letter from the SEC which denied the Georgia plea filed on June 8.

PSC Contests Rates

The PSC had contended that residential rates in the area serviced by the Georgia P&L are 30% higher and industrial rates were "substantially higher" than comparable rates in other contiguous counties served by the Georgia Power Co. The commission contended that the high industrial rates were a bar to the industrial development of the region.

Georgia P&L serves some 18 counties across south Georgia from Jakin, near the Alabama line to the Atlantic ocean. Some of the cities served are Valdosta, Waycross, Bainbridge, and Jessup.

Last year, the Georgia PSC held hearings to determine why the Georgia Power Co should not be required to buy these assets. Neither Georgia Power Co nor the Florida Power Corp expressed interest in working out any such transfer or sale. In fact, Georgia Power Co specifically said that it was not interested in buying Georgia P&L properties and at the same time Florida Power Corp said it wasn't interested in selling. However, the PSC continued pushing its case.

Interconnection Cited

In rejecting the petition of the Georgia PSC, the SEC said that the assets of the Florida Power and Georgia P&L are physically interconnected and that Georgia P&L derives substantially all of its power supply from Florida Power. The Georgia Public Service Commission had contended that GP&L bought a good portion of its power from Georgia Power. SEC also said that power rates in the area were being studied by both Florida Power and the SEC in an effort to see where some reductions might be made.

Hawaii PUC Urges Merger Of Hilo and Kona L&P

Another merger of electric utilities is being encouraged by the Public Utilities Commission of Hawaii.

It is urging at least an exchange of facilities if not an outright merger between the Hilo Electric Light Co and the Kona Light & Power Co.

The two firms together serve an area nearly as big as the state of Connecticut (4,030 sq mi vs 4,899), but because of its sparse, scattered population, the Kona rates are some of the highest in the U. S.

The PUC feels that they could be lowered by merger with the larger Hilo company. The issue is being forced by the need of the Kona company to acquire extra generation equipment by the end of the year to handle increased loads.

Banks Urged to Look At Electric Utility Bonds

A committee on investment of the savings and mortgage division of the American Bankers Association is urging commercial and savings banks to take a look at electric utility bonds for their investment portfolios.

This suggestion is contained in a booklet just published by the ABA entitled "Aids in the Selection of Electric Utility Bonds." It is prepared to give the salient investment features of the electric utility industry.

There are probably more dollars invested in the electric utilities industry than in any other single type of corporate enterprise, according to the booklet.

The industry presents an outstanding investment opportunity, the booklet points out, because

1. It is unique.
2. It is in a non-competitive position.
3. It has a record of growth.
4. It has demonstrated ability to withstand extreme fluctuations in the business cycle.
5. It has uniform accounting for the industry.

The booklet said: "The lack of competition between electric utility companies is even more marked than the relative uniqueness of their product. Throughout the country, these companies operate under franchise, providing for the most part, exclusive markets in given geographical areas."

Colorado PUC Approves Utility's Stock Offering

The Colorado Public Utilities Commission split, 2-1, in approving the sale by the Home Light & Power Co of Greeley of an additional 7,313 shares of common stock.

The net proceeds of the sale, about $289,000, would be used to retire short-term bank borrowings of $260,000 and for construction of new plant facilities.

Commissioner Joseph Hawley in his dissent wrote that the stockholders would get a "windfall" of $26,044.28 by being able to buy for $40 a share stock with a book value of $43.56. Hawley wrote, "There is no reason to assume this new issue . . . would sell for less than book value at a public offering."

FINANCIAL BRIEFS

St Joseph Light & Power Co has acquired the Missouri Service Co as of September 3.

To finance the first two years of construction on a $79 million expansion program, the Puget Sound Power & Light Co has entered into a $20 million credit agreement with 18 banks, half of which are in Seattle and the other half in the midwest and east. Loans, together with company funds, are expected to take care of initial construction of a $35 million dam on the Upper Baker River, as well as expan-

(*Continued on page* 178)

SAVE
ON YOUR REACTOR COSTS

10% by ordering aluminum conductor
8% more by ordering standard ratings

ALUMINUM CONDUCTOR IS NOW STANDARD on G-E cast-in-concrete current limiting reactors. Savings from the use of aluminum are being passed on to users. Aluminum has been adopted as standard because it is preferred by most utilities. Copper conductor reactors can still be furnished when desired, at a 10% higher price.

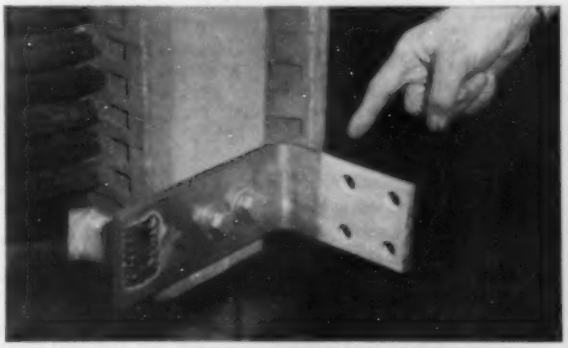
STANDARD RATINGS SAVE YOU MORE MONEY AND 2 TO 3 WEEKS ON SHIPMENT
A new RM (Repetitive Manufacture) program of standard reactor designs enables you to save an additional 8%. Stocked parts and streamlined manufacturing techniques also result in deliveries 2 to 3 weeks faster.

All standard ratings have aluminum conductor. They represent the ratings most often ordered, and include indoor and outdoor designs, single- or three-phase, for use on 4160-, 7200-, or 14,400-volt circuits. Ratings range from 100 to 700 amperes and from .10 to 2.5 ohms.

NEW ALUMINUM/COPPER TERMINAL—The standard terminal for aluminum conductor reactors is an aluminum alloy blade. However, for connection to copper bus, the aluminum terminal can be provided with a silver-plated copper end. A recently perfected technique of butt-welding aluminum to copper has made this new terminal possible. The weld is exceptionally strong, and is designed to withstand the severe stresses imposed by high current surges.

Take advantage now of these savings in reactor costs. For further information, see your G-E Apparatus Sales Engineer, or write for Bulletin GEA-6313, to Section 422-22, General Electric Co., Schenectady 5, N. Y.

BEN MONK, Manager of Transformer Apparatus Sales, points out how you can take advantage of these savings by buying aluminum-conductor reactors with standard ratings.



THE STANDARD ALUMINUM TERMINAL can be provided with a silver-plated copper end for connection to copper bus.

CONSIDERING ALL FACTORS YOU'LL WANT G-E REACTORS

GENERAL ELECTRIC

Financial Briefs

(*Continued from page* 176)

sion of transmission facilities and new office and service buildings. Drawing 3% interest, the loans will be refinanced by the sale of bonds, Pres Frank McLaughlin has announced.

Eastern Gas & Fuel Associates will pay October 1 a quarterly common stock dividend of 15¢ a share as compared with 10¢ a share in previous quarters.

Frontier Power Co has received Colorado Public Utilities Commission approval to sell its electric properties to the City of Walsenburg for about $750,000. Its properties in Huerfano and Las Animas counties would be sold to the San Isabel Electric Association of Pueblo for $1,165,000. Additional properties south of Trinidad extending into northern New Mexico would be sold to the Springer Electric Cooperative of Springer, N. Mex., for $85,000.

Blyth & Co has sold quickly a secondary offering of 5,000 common shares of Arizona Public Service Co at $25 a share.

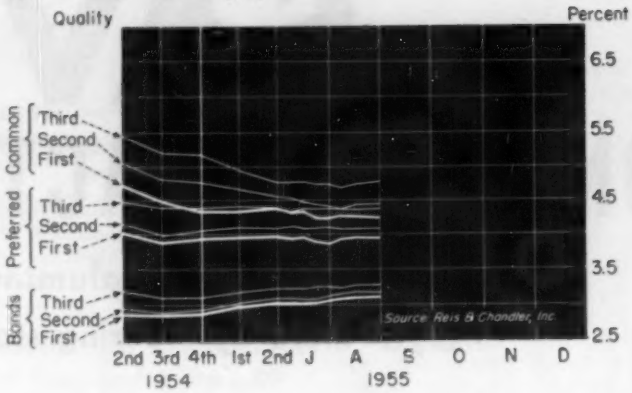
Government-owned Electricite et Gas d'Algerie has received a $10-million loan from the World Bank to help finance power development in Algeria. In addition three European banks will loan EGA $724,000 for a 20-year period at 4¼% interest rate.

Federal Power Commission has asked for comments by September 15 on proposal to amend rules relating to preservation of records of public utilities and licensees. FPC has also asked for comments by the same date on a proposal to revise Form FPC No. 6, initial statement showing actual legitimate original cost.

REGULATION BRIEFS

Dayton, Tenn., City Electric Department has announced an estimated $25,000 a year cut in rates. In approving the rate reduction, Dayton became one of 51 distributors of Tennessee Valley Authority Power with rates below the basic TVA level. There are 148 municipal and co-operative TVA power distributors.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Aug. 25	3.13	3.18	3.29	3.95	4.09	4.37	4.21	4.43	4.78
Aug. 18	3.11	3.16	3.26	3.94	4.06	4.37	4.23	4.42	4.76

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
California Electric & Power	6	June	$2,723,421	$2,636,964	$0.84(a)	$0.83(a)
Central Illinois Light	12	July	3,549,567	3,473,831	3.05(b)	3.05(b)
Central Maine Power	12	July	6,562,708	5,633,116	2.06	1.83
Cincinnati Gas & Electric	12	June	13,376,882	12,022,483	1.80(c)	1.63(c)
Houston Lighting & Power	12	July	13,812,091	11,539,913	2.30	2.11
Ohio Edison, consolidated	12	July	22,216,412	19,740,081	3.35(b)	3.04(b)

Notes—(a) Based on 2,668,934 shares in 1955 and 2,490,934 shares in 1954; (b) Based on average shares; (c) Based on 6,800,000 shares in 1955 and 6,700,050 shares in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
August 25–31			
BONDS			
California Electric Power—1st mtg 3⅛% due 1985	$6,000	101%	3.57%
COMMON STOCK			
Housatonic Public Service—about 11,200 sh	(Temporarily postponed)		
SCHEDULE FOR SEPTEMBER-OCTOBER			
BONDS AND DEBENTURES			
Utah Power & Light—1st mtg due 1985	$15,000		Sept. 13
Ohio Power—1st mtg due 1985	17,000		Sept. 20
Pacific Power & Light—1st mtg due 1985	10,000		Oct. 4
Public Service Electric & Gas—debs due 1975	35,000		Oct. 4
Worcester County Electric—1st mtg due 1985	8,500		Oct. 18
New York State Electric & Gas—1st mtg due 1985	25,000		Oct. 19
PREFERRED STOCK			
Ohio Power—60,000 sh $100 par	$6,000		Sept. 20
Public Service Electric & Gas—250,000 sh $100 par	25,000		Oct. 4
Pacific Power & Light—30,000 sh $100 par	3,000		Oct. 5
COMMON STOCK			
Utah Power & Light—177,500 sh			
Tampa Electric—197,532 sh (to be offered common-holders on 1-for-10 basis, record Sept. 20)			
Southern Co—1,004,870 sh (to be offered common-holders on 1-for-10 basis, record Oct. 19)			

STATISTICS

Trends in Households & Families

	April 1955	March 1950	% change
Households	47,788,000	43,554,000	9.7
Primary families	41,773,000	38,838,000	7.4
husband-wife	36,266,000	34,075,000	6.4
other male head	1,303,000	1,169,000	11.5
female head	4,144,000	3,594,000	15.3
Primary individuals	6,075,000	4,716,000	28.8
male	2,019,000	1,668,000	21.0
female	4,056,000	3,048,000	33.1

	April 1955	March 1950	% change
Families	41,934,000	39,303,000	6.7
Secondary families	221,000	465,000	−52.5
Subfamilies	1,969,000	2,402,000	−18.0
Married Couples	37,570,000	36,091,000	4.1
with own household	36,266,000	34,075,000	6.4
without own household	1,304,000	2,016,000	−35.3
Unrelated individuals	9,790,000	9,136,000	7.2
male	4,117,000	4,209,000	−2.2
female	5,673,000	4,927,000	15.1

In case you want to check some definitions —

households: includes all persons who occupy a house, apartment, or group of rooms. Does not include hotels, large rooming houses or institutions

unrelated individual: person not living with relatives

primary individual: household head living alone or with non-relatives

families: groups of two or more persons related by blood, marriage, or adoption, and residing together

primary family: includes the head of household

secondary family: resident employees or roomers

subfamily: family unit living in a household related to, but not including the head of the household

Source: Dept of Commerce

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	July	108.79	107.62	96.98	12.2
Peak—Class I Systems, million kw	June	86.6	83.9	78.1	10.8
Estimated Dec. '55 Peak	May	96.6	96.6	95.8	0.8
Production—billion kwhr	June	44.23	43.35	38.97	13.5
Hydro		9.71	9.81	9.58	1.3
Fuel		34.53	33.54	29.38	17.5
Sales—billion kwhr	June	40.17	39.57	34.33	17.0
Residential		9.57	9.71	8.82	8.4
Commercial		6.48	6.18	5.93	9.2
Industrial		21.75	21.35	17.32	25.6
Other		2.38	2.33	2.27	4.9
Fuel Consumption	June				
Coal—million tons		11.07	10.76	9.29	19.1
Oil—million barrels		4.69	4.88	4.29	9.5
Gas—billion cu ft		107.42	103.43	107.79	−0.8
Net Income Class A & B Co's—$ million	June	96.75	93.47	86.97	11.3
Residential Customers—millions	12 mos.	43.64	43.51	42.37	3.0
Revenue per kwhr	ended	2.67¢	2.67¢	2.72¢	−1.8
Avg kwhr per customer	May	2,637	2,622	2,429	8.6
Avg annual bill		$70.41	$70.01	$66.07	6.6

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	July	133	139	116	14.7
ENR Construction Cost	Aug.	141.0	138.4	134.6	4.8
BLS Cost-of-living	July	114.7	114.4	114.3	0.3
NEMA Sales	June				
insulation materials		158	154	124	27.4
electric appliances		122	110	102	19.6
household refrigerators		105	104	82	28.0
Wholesale prices	July				
Motors and generators		121.1	120.8	123.4	−1.9
Transformers and regulators		127.3	127.3	128.1	−0.6
Switchgear and fuses		135.5	135.5	135.1	0.3
GNP—annual rate—$ billion	2nd Qtr.	$385	$375.3	$357.6	7.1

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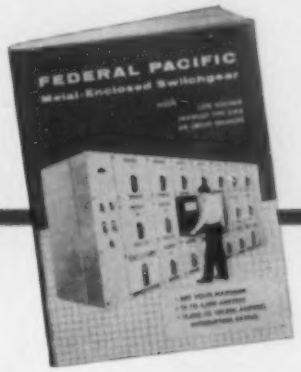

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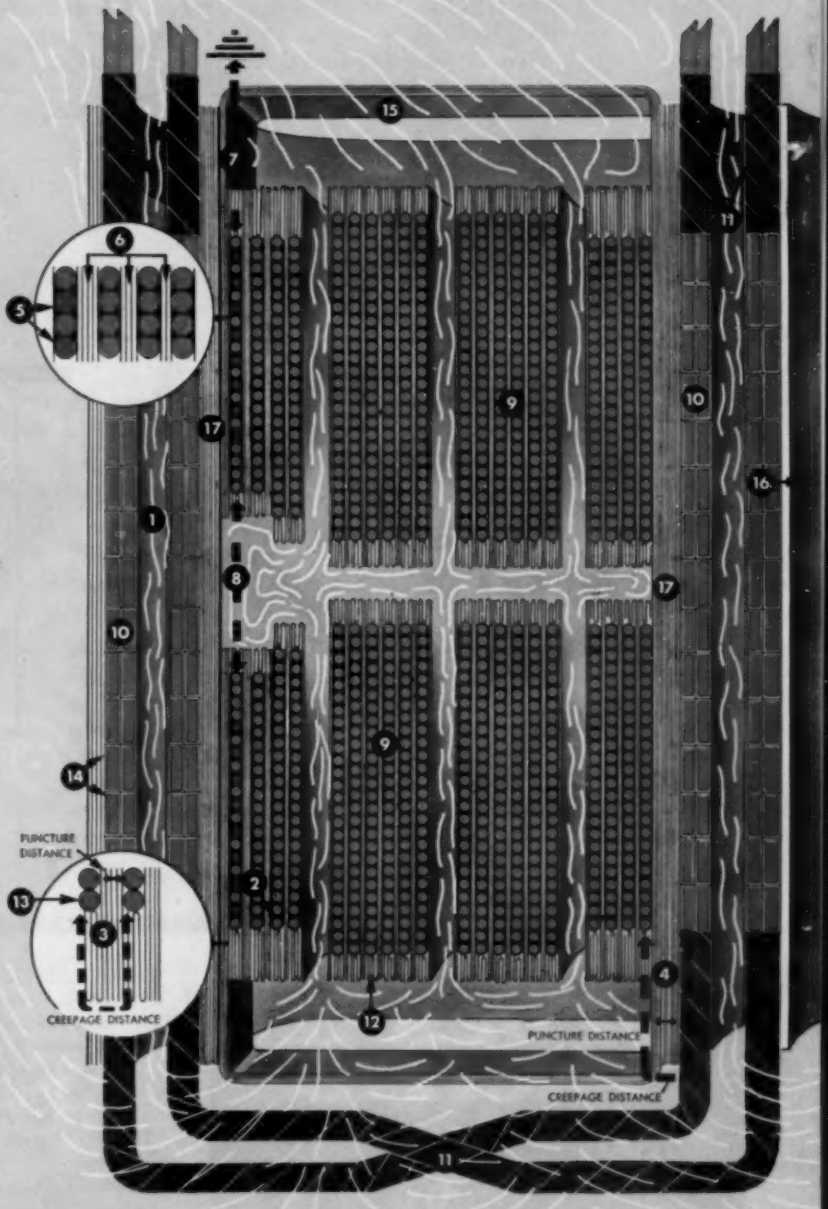

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